THE AMERICAN GAS LIGHT JOURNAL

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION HEATING, MECHANICAL, CHEMICAL AND GENERAL SCIENCE

VOLUME LXXXIX., No. 10. Whole No. 1,735. | NEW YORK, MONDAY, SEPTEMBER 7, 1908. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. | THOMAS J. CUNNINGHAM, ELBERT P. CALLENDER, Editors.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

Published on each Monday of the year, at No. 42 Pine Street, New York City.

Telephone.—2906 John.

Terms of Subscription, Including Postage.—For the United States, $3; Canada, $4 per annum. European countries, $5 (£1—25 francs).

Remittances should be made either by post office order, express money order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

Collections are invariably made directly from this office for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them. All payments to be made in advance. Single copies, 10 cents.

Indexes for the previous 6 months will be found in the First number of July and the First number of January.

Books.—We will forward by express, at publisher's lowest rates, any book—scientific or otherwise—to any address in the United States or Canada. We would suggest to our patrons that to avoid the risk and expense consequent on sending us the money (we do not send books C. O. D.), that orders for books be sent us through the Purchasing Department of the American Express Company.

The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

CONTENTS.

An Asterisk (*) Denotes an Illustrated Article.

OFFICIAL NOTICES—

Sixteenth Annual Meeting, Pacific Coast Gas Association..... 397
Seventeenth Annual Meeting, Michigan Gas Association..... 398
Annual Meeting, Empire State Gas and Electric Association..... 398
Wrinkle Department, American Gas Institute..... 398
The American Gas Institute Response Vote..... 398

EDITORIALS—

Briefly Told..... 398
Death of Mr. B. Frank Ellison—Current Mention.
*Chats on Making Holes in Pipes, by "Engineer"..... 399
Rules and Standards Regarding Gas Service in Wisconsin, as Formulated by the Railroad Commission of that State..... 400
The Effect of Practical Working of the Seals and Pressures in the Hydraulic Main and Retort, by H. G. Colman..... 401
*Integrating Photometer..... 404
*Electrical Generating System of the Newton (N. J.) Gas and Electric Company..... 405
Is Supplying Electricity a Natural Monopoly?..... 407
*Lackawanna Steel Sheet Piling..... 407
*Improvements in Luminous Arc Electric Lamps..... 408
Illumination and our Eyesight..... 409
Attitude of the Law Toward Electricity..... 410

ITEMS OF INTEREST FROM VARIOUS LOCALITIES..... 410
Mr. John L. Beggs' Promises the Apprentices Bibles—Change in Headquarters—Personal—The Havre de Grace (Md.) Plant—The General Coke and Gas Company—An Order, New York Public Service Commission—Contracts for the Gas Bench Construction Company—A Mandamus Suit—Preparing a Merger, Riverside, Cal.—Meters are Personal Property—The "Lucky Jingle"—Hearing before New York Public Service Commission—The Alderman and the East Pueblo Company—A Hint from Keene, N. H.—Public Lighting, Boston—And Other Items.

The Market for Gas Securities..... 412

[OFFICIAL NOTICE.]

Sixteenth Annual Meeting, Pacific Coast Gas Association.

PACIFIC COAST GAS ASSOCIATION,
OFFICE OF THE SECRETARY,
925 FRANKLIN ST., SAN FRANCISCO, CAL.,
August 25, 1908.

To the Members of the Pacific Coast Gas Association: Come one, come all. Never an idle moment. The 16th annual convention will be held in Santa Cruz, Cal., September 15th, 16th and 17th, 1908.

The success of the 15th convention will be repeated. Seven papers of unusual interest will be read. Our "Experience" and "Wrinkle" Editors are busy. Outing will be arranged for; and, of course, don't forget the banquet.

Big attendance desired to make our 16th meeting a success. Details covering railroad and hotel rates follow. Get in line and rally 'round our President, Mr. C. O. G. Miller, and help make our 16th meeting the meeting of all meetings. Bye-the-bye, do a little field work and help swell our ranks. A line to this office will bring forth the necessary application blanks. Of course, by all means bring the ladies.

ROUTE CARD.

The following arrangements have been made with the railroad companies and the hotels for the benefit of the members of the Association:

Railroad Rates.—The Southern Pacific Company will put into effect their convention rate of 1½ lowest, first-class fare for the round trip from all points in California, including Reno, Nev., to Santa Cruz and return. Tickets for going trip may be purchased from September 5th to 17th, inclusive, and the certificates will be honored for the return at one-third rate from September 15th to 19th. The Santa Fe Railroad Company has notified us that the same rate will apply from all points on its lines in the San Joaquin Valley.

Special Notice.—At the time of purchasing your ticket be sure and secure your "receipt certificate," in order that you may derive the benefit of the above rate. The railroad companies have notified us that they will not consider any request for the refund in the event of members failing to obtain the receipt certificates at the time of purchasing their tickets.

Hotel Rates.—The following special rates have been named: For the reception of the members the Sea Beach Hotel, which was to have closed on September 14th, has consented to remain open until after the convention, and has named the following rates for members and their families: $3 per day for room without bath, American plan; $4 per day for room with bath. St. George Hotel, American plan, $2.50 per day.

The General Manager of the Santa Cruz Beach Company has made the following rates for the members desiring to stop at Cottage City: For single room cottage, $1 per day for one person; 50 cents extra if occupied by two people. For double-room cottage, $1.25 per day, and 50 cents extra per person, if occupied by more than two people. Meals can be had at the Casino Grill at all hours.

Get busy now and make your arrangements accordingly, and if you don't enjoy your outing it will be through no fault of the Association.

SEP 8 1908

In connection with literature of the Association we have in stock 40 books, Vol. 1, of the "Proceedings," embracing the years 1893 to 1897, both inclusive; also, quite a number of Vol. 6, embracing the years 1905 and 1906, which we will be glad to forward to members, while the supply lasts, at the price of $1 for each volume postpaid, cash to accompany order.

There is also a small supply of the "Rix Pamphlet," covering paper read before the 13th convention of the Association, by Mr. E. A. Rix, on "The Compression and Transmission of Illuminating Gas," which will be forwarded to members postpaid, upon receipt of 50 cents, cash to accompany order. It may be that some of the members desire to purchase the above for presentation to the libraries in their respective localities. Yours very truly, JOHN A. BRITTON, Secretary.

[OFFICIAL NOTICE.]

Seventeenth Annual Meeting, Michigan Gas Association.

MICHIGAN GAS ASSOCIATION,
OFFICE OF THE SECRETARY,
DETROIT, MICH., Aug. 24, 1908.

To the Members of the Michigan Gas Association: The Seventeenth Annual Meeting of the Michigan Gas Association will be held at Kalamazoo, September 23d, 24th and 25th.

Our programme this year includes an exceptionally interesting paper prepared at the University of Michigan, by Professor Alfred H. White and Messrs. Fred. A. Park and Wm. A. Dunkley, on "The Destructive Distillation of Coal at Low Temperatures;" a paper by Mr. G. W. McKee, of the Peoples Gas Light and Coke Company, Chicago, Ills., on "Industrial Gas;" a combination paper, by Mr. Jayne, of Detroit, on "The Distribution System in Detroit," and by Mr. Wm. Seymour, of the Grand Rapids Gas Light Company, on "The Distribution System in Grand Rapids;" a paper by Mr. E. St. Elmo Lewis, Advertising Manager of the Burroughs Adding Machine Company, Detroit, on "Advertising as it Affects a Public Service Corporation;" a paper by Mr. Clark R. Graves, of Detroit, on "New Business;" a paper by Mr. F. R. Remington, of Battle Creek, on "Labor Saving in a Medium Sized Plant."

The headquarters of the Association will be at the Burdick House, and rates have been arranged as follows: American plan, $3.50, $4 and $4.50. European plan, $2, $2.50 and $3—these prices are all for rooms with bath. Rooms without bath, $2.50, $3.50, American plan; $1.50, $2 and $2.50, European plan. Reservation should be made in advance to secure the best.

The Burdick House was selected on account of its being centrally located. There are, however, two other good hotels: The Rickman and the American House. The Rickman, a new American plan hotel; rooms with bath, $2.50 per day: American House, American plan, $3 per day, with bath. Rooms without bath, $2 and $2.50.

The meetings will be held one block away from the hotel, in the rooms of the Commercial Club, and opportunity will there be given for an appliance display.

Wednesday night (the 23d) there will be an informal dinner at the Burdick House, and entertainment is to be provided in part by Mr. Adams, a representative of the Anchor Packing Company, of Detroit. On Thursday evening (the 24th) there will be a complimentary theater party. ALONZO P. EWING, Secretary.

[OFFICIAL NOTICE.]

Annual Meeting, Empire State Gas and Electric Association.

EMPIRE STATE AND ELECTRIC ASSOCIATION,
OFFICE OF THE SECRETARY,
154 Nassau street, N. Y., September 1, 1908.

Gentlemen: The annual meeting of this Association will be held in the United Engineering Societies Building, 29 West 39th street, October 7, 1908. Among the subjects to be discussed are: "Public Policy Work of the Association." "Standards for Gas Service and Standards for Electric Service, Taking as a Basis the Recent Rules of the Railroad Commission of Wisconsin." "Taxation of Gas and Electric Companies in New York State with a Report from the Taxation Committee." "Insurance of Gas and Electric Stations." "Review of the Decisions of the Public Service Commissions." "Electric Meter Testing with Report of the Meter Committee." "Accounting, with Report of the Accounting Committee." "Amendments to the Constitution and By-laws with a New Schedule of Annual Dues." "Affiliation with the American Gas Institute and the National Electric Light Association."

All of the details of the programme have not been completed, but it is expected that the meeting will be exceptionally interesting.

Truly Yours, CHARLES H. B. CHAPIN, Secretary.

[OFFICIAL NOTICE.]

Wrinkle Department, American Gas Institute.

To the Members of the American Gas Institute: All members of the Institute are earnestly requested to send in as soon as possible contributions for this year's Wrinkle Department report. The success of the Department depends entirely on the co-operation and assistance of the members.

Mail all contributions to Milan R. Bump, Editor, No. 60 Wall street, New York city.

[OFFICIAL NOTICE.]

The American Gas Institute Response Vote.

HEADQUARTERS, AMERICAN GAS INSTITUTE,
25-29 WEST 39TH STREET,
NEW YORK, August 10, 1908.

To the Members of the American Gas Institute: The Committee of Arrangements, for the meeting to be held in New York next October, is very much gratified by the response to the Committee's request for information. The replies so far received indicate a very large attendance; but there are still 700 members who have failed to fill out and return the postal card sent to them. It will materially assist the Committee of Arrangements if these 700 members will be good enough to fill out the postal card and mail at once.

COMMITTEE OF ARRANGEMENTS, by
W. R. ADDICKS, Chairman.

BRIEFLY TOLD.

DEATH OF MR. B. FRANK ELLISON.—A telegram from Mr. Paul Doty, Vice-President and General Manager of the St. Paul Gas Light Company, informs us of the death, presumably at Superior, Wis., on Wednesday, the 2d inst., of Mr. B. Frank Ellison, General Manager of the Superior (Wis.) Water, Light and Power Company. This sad news will be regretfully received by many of the rank-and-file of the fraternity, for "Frank," as he was familiarly called by his close associates, was the sort of man who holds close to his personality the friends that he makes. Prior to his taking charge at Superior, Mr. Ellison had been prominently identified with the old St. Paul Gas Light Company, as its Superintendent, during the stormy times that Company experienced of the triumvirate days there of the Sibley-Patterson-Scott regime—and that period is well over 20 years ago. The writer of this knew him well for upwards of a quarter century, and here bears testimony to one of Mr. Ellison's strong points of character—complete, unswerving fidelity to the interests of his ranking officers. In fact, from a material point of view, he could have been far better off in this world's goods were his fealty less staunch. The funeral services were held in St. Paul, the afternoon of Thursday last.

CURRENT MENTION.—

THE Selectmen of Whitman, Mass., have granted the franchise asked for by the promoters of the proposed gas company for that place. The project, as heretofore mentioned, is controlled by Haverhill capitalists.

FROM the reports recently made up by Manager Snow for the year's operation of the Holyoke, Mass., municipal gas works—the figures have to do with the twelvemonth ended June 30th—it is shown that the gain in sendout for this twelvemonth as against the corresponding year figures out at 18.9 per cent. The sendout totalled 177,536,000 cubic feet.

THE Consumers Gas Company, of Reading, Pa., is now engaged in the working-up of its coal tar product, a suitable distilling apparatus having been erected nearby the Company's generating station.

WE understand that Mr. Alfred W. Glass, of Detroit, Mich., and associates, are contemplating the erection and operation of a gas plant in Manistique, Mich.

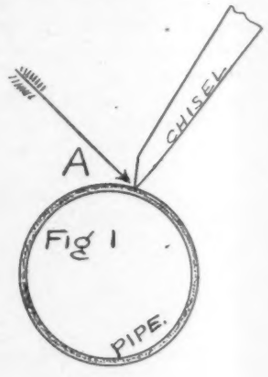
MR. A. B. SLATER has returned from Rio Janeiro, Brazil, looking as well as he did when he left us about 3 years ago. He is through with Brazil and Brazilieros, and proposes to engage in the gas business in the States in due time. He is the same "Al.," active and erect, with not a trace of black-and-tan over his face. Temporarily his headquarters will be in Bridgeport, Conn.

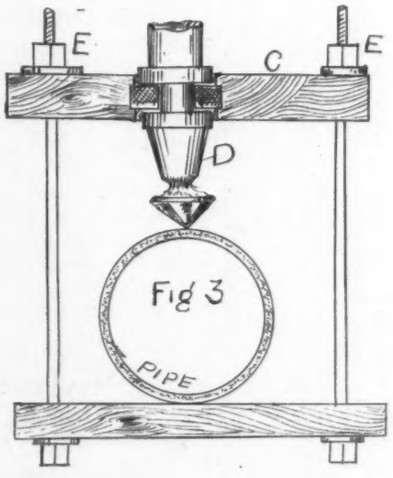
"T. M. B., writing from Los Angeles, Cal., under date of the 27th ult., says that October 1st is the date set for the transfer of the City Gas Company of this place to Messrs. H. G. Huntington, W. G. Kerchoff and the Pacific Light and Power Company, who are reported to have paid $1,350,000 for the property.

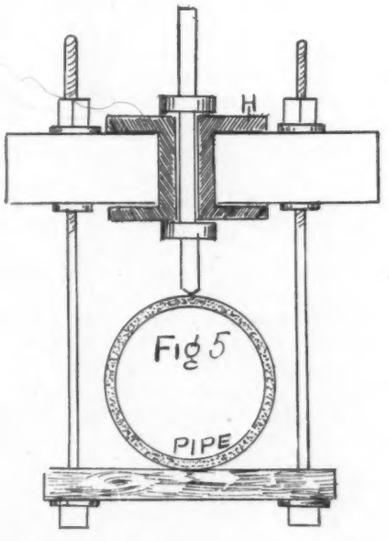
Chats on Making Holes in Pipes.

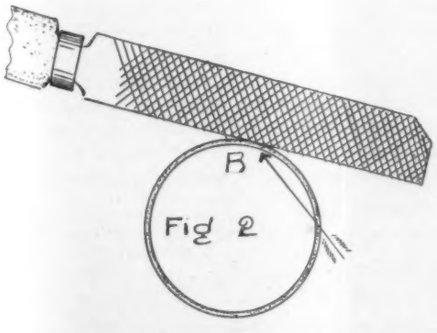
[Communicated by "ENGINEER."]

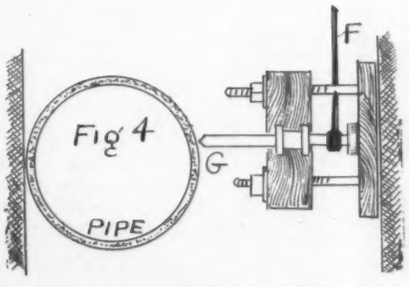
Recently I noticed the different systems employed in making holes in gas mains and other gas pipes while the pipes were still in the ground or suspended in use somewhere in a building. Perhaps the crudest method I observed consisted in chipping a hole through the pipe wall by using a common cold chisel with a machinist's hammer to drive. The plan is illustrated in Fig. 1. A certain underground pipe, about 6 inches in diameter, had to be tapped into in order to put an inch joint therein for a corresponding gas branch. Instead of going to the trouble of making a round bore, with the customary taps and brace, the pipe fitter went to work at it with the cold chisel, as at *A*. He had to utilize one edge of the tool, as to cut with the full blade would have made a hole too expansive. So, after considerable hacking and gouging, a hole was plied through the wall. Then the man had to proceed to work with a round and half-flat file to smooth off the edges and make the hole circular to receive the pipe joint. He worked and fretted a good hour or more, and when the joint was installed, oakum had to be used in liberal stock to help close the union tight enough to avoid a leak.

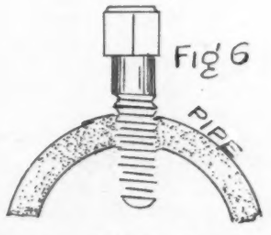












Next I witnessed a party creating an opening in a pipe wall under similar conditions with a file. Now, when you file across a pipe, as at *B*, Fig. 2, you are liable to make more of a surface hole than you desire. But by remarkably skilful manipulation of the file, the workman managed to thin down a place in the wall of the pipe, which thin place was caved through with light pressure and a ragged hole resulted. Luckily the pipe to be inserted was of good sized proportions, and the workman was enabled to enlarge the opening with a round file, to the point where the edges of the pipe wall remained thick enough for retaining a cut thread thereupon. Hence the hole was made and the threads tapped in it in the usual manner. In addition to these two crude modes of penetrating a gas main, several other systems of a crude character prevail, as is well known in the profession. The other day I heard considerable hammering and chipping and on tracing it down saw a man actually cutting a hole through a gas main wall with the point of a steel punch. The punch was large and the driving hammer the man was using made a telling blow at every drive. Gradually the point of the punch was driven through the metal.

Then there are men with sufficient patience and strength to make a hole in a pipe by using the shoulder brace. This means that the man has to apply his deadweight on the brace, and turn the same a great many times with an unusually keenly pointed cutting tool in order to make any impression on the hard metal. If the tool edge lacks a good cutting point, the undertaking will be very difficult.

There are various patented devices on the market for cutting holes in pipes, while the pipes are under pressure, some of which instruments are very good.

Fig. 3 shows a home-made tool constructed with a view of tapping a pipe. In the use of this device it is necessary to get below the pipe to adjust the back brace. In case the pipe is suspended, as in an apartment, the back can be gotten at very readily. If the pipe is underground then considerable earth may have to be removed under the pipe to pass the brace below. Two pieces of hardwood form the braces. There are two long bolts, with nuts *E*, *E*, affixed to the same. These bolts pass through the braces in holes bored for the purpose. Then the boring tool is adjusted, as at *D*. The boring tool is a plain drill, except that flanges must be keyed on, or, if the drill shaft is large enough in diameter, the same can be grooved, to form a collar in which the cam of the journal of the top brace can turn. The object is to hold the boring tool down and exert pressure thereupon by turning the nuts *E E* on the bolts. Hence the instrument is properly adjusted and boring proceeds, while the slack is taken up and pressure generated on the point of the drill by turning up on the nuts of the bolts. A system of boring, with the pressure of the braces all on one side of the pipe, is shown in Fig. 4, in which the pipe is shown against the wall of the trench on one side, while the boring tool occupies the other side. In this device a ratchet is used to do the turning. The handle is marked *F*, the boring point being marked *G*. The brace holding the boring tool is simply expanded outward and toward the pipe wall as the boring proceeds. A hole is drilled in quick time.

Fig. 5 shows another boring contrivance of a home-made description. The collar, *H*, is made of brass and supports the flanged boring tool as shown in the cross-sectional drawing. The collar is fitted into the wood bracepiece. The under brace is also of wood, and the connecting rods are used, as in Fig. 3. The point of boring is marked *J*. After the hole is properly cut, the tapping is easily effected with the tap, as in Fig. 6. Then the necessary joint or pipe can be turned in and the job is finished.

MR. GEORGE ROSE has resigned from the position of Manager to the Anaheim (Cal.) Gas Company.

[OFFICIAL.]

Rules and Standards Regarding Gas Service in Wisconsin, as Formulated by the Railroad Commission of that State.

Adequate service is not necessarily the best service which it is possible to give, but rather the best service which can be given with due regard to economy to the consumer and to the company. The kind of service prescribed should not be materially different from that furnished by companies operated under the best management and giving the best service. There may be certain conditions surrounding the gas industry in this State which make it desirable to prescribe certain standards which may not necessarily be the best standards in other States where the conditions may be different. The gas companies themselves should conduct all tests, as far as practicable, and take care of all complaints of service in the same manner that complaints are being taken care of by companies under the best management.

Each company is required to have an equipment of measuring and testing devices, approved by the Railroad Commission, and the Commission's gas inspectors will assist the companies in maintaining this equipment in a suitable condition by comparison with standards under the direct control of the Railroad Commission.

All companies should be equipped with apparatus for testing the accuracy of meters, apparatus for testing gas for the presence of sulphuretted hydrogen, and gauges for the measurement of gas pressures. It is desirable that each company own a standard calorimeter for determining the heating value of gas, but it is recognized that such a requirement might entail an unwarranted expense on the part of some of the smaller companies. However, companies manufacturing over 20 million feet of gas per year should own a calorimeter outfit. Companies may use any type of instrument capable of giving correct indications, subject to approval by the Railroad Commission.

It is not believed desirable at this time to prescribe the exact specifications and details for the methods of making various tests, since further investigation will be necessary before the best methods can be determined. It is impossible, for example, to make satisfactory recommendations as to which of the various types of calorimeters available will serve most satisfactorily for determining the heating value of commercial gas sold for heat, light and power purposes. An investigation of the properties of the various calorimeters is now being carried on by a committee of the American Gas Institute, with which committee certain members of the engineering staff of the Commission are co-operating. It is hoped that when the committee makes it report next fall, information will be available upon which recommendations as to the best method for determining the heating value of gas can be made. Efforts have thus far been unsuccessful in selecting a suitable form of standard cubic foot bottle to be used for standardizing meter provers. These two instances are mentioned as examples of some of the problems which the engineers of the Commission are considering.

Adequacy of gas service may be considered under the following headings: (1), accuracy of meters; (2), heating value; (3), candle power; (4), gas pressure; (5), purity of gas.

1. *Accuracy of Meters.*—The accuracy of a gas meter may be defined in terms of the percentage with which it registers the actual volume of gas which passes through it. In the present state of the meter art it is impossible to secure a meter which is absolutely accurate and which will remain accurate over a period of time. It is, therefore, necessary to define the term "accuracy" in such a way as to permit meters which fall within a small limit of error being considered as giving good service. The common method of testing the accuracy of a meter is to compare its reading with the volume of gas as measured by the well known "meter prover." It requires more than ordinary skill to measure the volume of gas with the meter prover so as to be certain of its value within ½ of 1 per cent., and ordinarily, in making the measurements, errors of observation or inaccuracy of the meter prover itself can amount to 1 per cent. Inasmuch as commercial meters cannot be made and adjusted to keep within this limit, a further allowance appears necessary and for such allowance 1 per cent. seems a figure practically attainable.

Among the various tests to which meters are subjected in commercial testing are the following: The examination for leakage, the determination of the registration of the meter when passing a very small amount of gas, and the determination of the accuracy of registration when passing gas at various rates up to its highest capacity. The percentage of error on light load may be somewhat different from that on full load. To meet the practical requirements it is common to specify that the test of accuracy shall be made when the meters are passing gas at a certain rate, and the rate most commonly adopted is the number of cubic feet passing per hour, which is equal to the rated capacity of the meter in number of lights, multiplied by 6; that is, the normal rate of flow of gas in a 5-light meter will be 5 by 6, or 30 cubic feet per hour. A 5-light meter is capable of passing two or three times as much gas, but perhaps the average rate with which the meter will pass gas under the various conditions of service may be taken as 6 cubic feet per light. The following definition is therefore suggested as defining a commercially accurate meter:

Rule 1.—A meter may be considered as correct if, when passing gas at the rate of 6 cubic feet per hour per light capacity, it shows, in comparison with a standard gas prover, an error which is not greater than 2 per cent.

A meter should not be placed in service which cannot meet the above definition of accuracy, and a meter which, after having been placed in service, becomes more than 2 per cent., either fast or slow, should be repaired or readjusted.

Although accurate when installed, a gas meter may become either fast or slow, depending upon various conditions, such as the type of construction, quality of gas, temperature and other factors, and it is essential not only that gas companies should install accurate meters but that they should maintain them at a high degree of accuracy. This can be done only by periodic removal of each gas meter to the testing laboratory for overhauling and standardization. The practice among gas companies varies greatly as to the length of time in which meters are allowed to remain in service. Some companies make it a practice to inspect all of their meters at least once in 3 years, while others place the time at 4 years and upwards, and instances have been found where meters have been kept in place 7, 8 and 9 years. In the case of meters of large size it is customary to make more frequent inspections than with the ordinary size of meter, such meters being taken in frequently—once a year, or even oftener. It appears that the following rule would insure a reasonably satisfactory meter maintenance:

Rule 2.—No gas company shall allow a gas meter to remain in service for a period longer than 3 years without checking it for accuracy and readjusting it if found to be inaccurate.

Rule 3.—Each company shall keep a record of tests made on meters before installation and upon receiving them from the services.

Rule 4.—Each gas company shall provide itself with equipment necessary for testing meters, such equipment to consist of a standard meter prover with suitable accessories.

The carrying out of the periodic tests should not absolve the gas companies from making tests on meters upon request or complaint of consumers, but they should not be required to make tests when complaint is made with unreasonable frequency on the part of any one consumer. The following regulations meet this requirement:

Rule 5.—Each gas company shall make a test of the accuracy of a meter upon request of a consumer, provided such consumer does not make a request for test more frequently than once in 6 months. A report giving the results of such tests shall be made to the consumer, and a complete record of such tests shall be kept on file in the office of the company.

There will undoubtedly be instances where the test made and reported by the company may not be satisfactory to the consumer making the complaint, and other cases where the consumer may wish to have tests made without application to the company. The following procedure is therefore outlined:

Rule 6.—Upon formal application of any consumer to the Railroad Commission a test shall be made upon the consumer's meter by an inspector employed by the Railroad Commission, such test to be made as soon as practicable after receipt of the application. For such test a fee of $2 shall be paid by the consumer making application for the test if the meter is found to be slow or correct within the allowable limits and by the company owning the meter, if the meter is found to be fast beyond the allowable limits.

It is desirable, from the standpoint of good service, that the consumers be encouraged in every way to keep watch of their meter indications, and to this end it is prescribed that

Rule 7.—Meter dials shall read directly in cubic feet of gas, and bills rendered periodically by the company shall designate the readings of the meter at the beginning and end of the time for which the bill is rendered, and give the dates at which the readings were taken.

2. *Heating Value.*—Under conditions governing the use of gas in Wisconsin, it appears that by far the largest amount is used for purposes such that its heating value is a measure of the serviceable

value of the gas. There is a small percentage of gas consumption, believed to be materially under 10 per cent., which is used in open flame burners, and in which the candle power is a measure of its value. Since the gas so used is but a small percentage of the total, and this percentage is continually decreasing, due to the increasing use of the incandescent mantles, it appears that a calorific standard may be of far greater service than is the commonly used candle power standard.

The common method of expressing the heating value of a gas is in the number of British Thermal Units, generally abbreviated B.T.U., developed upon the combustion of 1 cubic foot of gas, as measured under standard conditions of temperature and pressure. Some authorities prefer to express the heating value of a gas as the so-called "net heating value,' which is obtained by subtracting from the total number of heat units liberated the heat units which are liberated by the water formed in the products of combustion in cooling from vapor at the boiling point to water at that temperature to which the products of combustion are cooled. It is true that, for most purposes to which gas is applied, this latent heat of the water of combustion does not become available, but there are other uses to which the gas is put in which this heat becomes useful. There are few, if any, gas consuming devices in commercial use which utilize all of the heat which is measured on a standard calorimeter, the percentage of loss depending upon the temperature at which the products of combustion escape. It appears, then, that for purposes of standardizing a gas in such a way as to avoid bringing into consideration the kind of burner in which it is employed and the purpose for which it is used, the standard should specify the total heat which is liberated by the gas. Consequently the total heat value, sometimes called the "gross value," is recommended as the standard.

In general, it may be stated, other things being equal, that gas is of the greatest value which has the greatest number of heat units per cubic foot, and it is possible to obtain a gas which has 800 or more B.T.U. per cubic foot. Such a gas is more costly, however, to the consumer, on account of the disproportionate expense of securing the high heating value. It is believed that the heating value standard adopted should be that value which will give satisfactory service in the forms of appliances commercially in use, and that it shall be such value as may enable gas to be sold at the most reasonable cost to the consumer. A value of 600 B.T.U. per cubic foot is believed to meet these requirements fairly well. Records of tests made upon various plants in this State show a range of heating values between the limits of 193 and 1,050 B.T.U. per cubic foot, the majority of tests showing a value of about 600. The larger proportion of the gas made in this State is what is known as coal gas, produced by the distillation of coal in retorts. It is possible, by the use of a good grade of coal, and by the exercise of good management, to secure a heating value of about 600 B.T.U. Plain water gas has a much lower value, which is usually raised by oil enrichment to 600 B.T.U. or upward.

The heating value of a gas decreases to some extent with the distance that is transmitted. This is due to condensation of some of the constituents, and is especially marked in cold weather. In prescribing the standard of gas, therefore, it should be specified that the test is to be made within a certain distance of the center of distribution, and 1 mile is suggested as a satisfactory distance. It is desirable, not only that the heating value be maintained above a certain amount, but that it should not be allowed to vary from this amount through too wide a range, since a gas which fluctuates greatly is almost as unsatisfactory as one which has an abnormally low heating value. A certain range of variation is necessary on account of the varying conditions met with in gas plant management.

The following regulation is suggested as providing for adequate gas service from the standpoint of heating value:

Rule 8.—The company furnishing gas which, within 1 mile radius from the distribution center, gives a monthly average total heating value of not less than 600 B.T.U., with a minimum which shall never fall below 550 B.T.U., may be considered as giving adequate service as far as the heating value of the gas is concerned.

Rule 9.—Each gas company, whose output exceeds 20 millions cubic feet a year, shall equip itself with a standard calorimeter outfit, with which periodic tests upon the gas shall be made. A record of these tests shall be made and kept open for public inspection.

3. *Candle Power.*—For the reasons previously outlined, it appears that the candle power standard, which has been almost universally used in the past for gas measurements, is of minor importance in this State. It is possible to secure a high candle power gas which has but a moderate heating value, and to require companies to maintain a double standard which shall insure both the high heating value and a high candle power, would surround them with such restrictions that economy in manufacture might not be attained, and since but few consumers would be benefited by a candle power restriction, and with this number continually decreasing, no regulations as to candle power are prescribed at this time. It should be added, however, that with a 600 B.T.U. heating standard, and in view of the conditions under which gas is being manufactured in this State, a fairly satisfactory illuminating value is insured. It is hardly possible to manufacture a coal gas of 600 B.T.U. which shall not have a candle power from 12 to 16, or even more. The enrichment of a water gas up to 600 B.T.U. will insure an even higher candle power.

4. *Gas Pressure.*—Almost as important as the calorific value is the pressure at which the gas is delivered. The ordinary burners and appliances in general use for consuming gas are designed and constructed to operate on pressures of somewhere between 1½ to 5 or 6 inches of water pressure. Means for adjustment are usually provided so that any burner may be made to consume gas most efficiently at that pressure at which the gas is being delivered. That adjustment which will give the best results for one pressure may not give the best results if the pressure changes, and consequently a variation of pressure necessitates a corresponding adjustment or a correspond ing variation in the efficiency and satisfaction given by the gas. An ideal condition is one in which gas is furnished at an absolutely uniform pressure, but the attainment of this is not consistent with economical management, and a certain range of variation should be permissible. It appears that a pressure equivalent to 1½ inches of water is the lowest pressure at which gas can be satisfactorily delivered, and that 6 inches is the highest at which it should be delivered to any consumer's meter unless some unusual or special type of burner is employed. It is believed that with the following regulation, the consumer will be assured of a reasonable gas pressure, and that the gas companies will be assured at the same time of a reasonable flexibility in the operation of their systems.

Rule 10.—Gas pressure, as measured at meter inlets, shall never be less than 1½ inches nor more than 6 inches of water pressure; and the daily variation of pressure at the inlet of any one meter on the system shall never be greater than 100 per cent. of the minimum pressure.

Rule 11.—Each company shall make frequent measurements of the pressure and pressure variations, and these shall be kept on record and open for public inspection.

5. *Purity of Gas.*—*Rule* 12.—In no case shall the gas contain more than 30 grains of total sulphur per 100 cubic feet, and not more than a trace of sulphur as sulphuretted hydrogen.

To determine the total sulphur usually requires greater skill and more apparatus than is commonly available to the smaller gas companies, and rather than require the smaller gas companies to make continual tests, it may be desirable to depend upon tests made by the inspectors of the Railroad Commission. The larger companies can readily make these tests, and it is desirable to have them made at least once a week. The ordinary test for sulphuretted hydrogen is a simple one, and should be employed by every gas works in making daily determinations. A definition of the amount of sulphuretted hydrogen which may be considered as being "more than a trace" is to be given later. The allowance of 30 grains of total sulphur appears to be amply large to allow the companies operating in this State to come within its limit. No restriction as to the amount of ammonia in gas seems to be necessary.

Rule 13.—Each company shall keep a record of complaints which shall include the name and address of the consumer, the date, the nature of the complaint, and the remedy. A classified summary of these records shall be submitted to the Commission on or before the 28th day of each month for the preceding month.

The Effect of Practical Working of the Seals and Pressures in the Hydraulic Main and Retort.

[A lecture by Dr. HAROLD G. COLMAN, at the August Meeting of the Irish Association of Gas Managers]

When your Honorable Secretary first asked me to speak at this meeting, he added the request that I would choose some subject which might prove of use and interest to those of you having the control of smaller works. With this request I will try to comply, and though the choice of a subject is always a matter of difficulty, largely because the number of possibilities is so great, I think that some matters connected with retort house working will probably prove most suitable.

The whole question of carbonization has at present reached a most interesting stage, and the eyes of all of us are irresistibly attracted to the newer developments now being so actively worked upon both here and abroad, including the employment of the completely filled retort, charged either continuously or intermittently, as well as the carbonization of the coal in larger bulk than is the case in gas retorts, such as occurs in the large carbonizing chambers or still larger coke ovens. Whatever may be the ultimate success of any or all of these processes, I for one feel convinced that the eventual result will be a material alteration in the methods adopted in gas works, which have undergone but little change in general principles for the past 100 years, greatly though they have been modified and improved in detail.

But while fully admitting the probability of important changes in the near future, it seems to me that it would nevertheless be a great mistake to concentrate our attention solely on the newer developments and to neglect the full consideration of the existing method of carbonization in horizontal or inclined retorts only partially filled with coal. The newer systems, however successful, can only come into use gradually, and for many years to come the horizontal retort will still be the means by which the bulk of the coal gas is made, especially in smaller works. Until the time comes for the relegation of these to the museum, as representing past history, every effort should be made to obtain the best possible results from them.

In the working of horizontal, or indeed of any form of retort or oven, it is self-evident that the first essential is the maintenance of good and even temperatures throughout the settings, for unless this condition is fulfilled, the prime object of the manufacture—namely, the driving off of the volatile matter from the coal—cannot be properly effected, and subsequent working, however good, can never compensate for failure in this respect. But while it is true that good and regular heats are the *sine quâ non* of gas manufacture, it is equally true that much of the advantage gained by good working in this point may be largely lost through unsuitable disposition and working of the subsequent retort house plant, and it is with regard to the latter that I propose especially to occupy your time to-day, for these are matters which are of equal importance to gas managers, whether they have only two or three beds of retorts, or whether they have a hundred.

After I had sketched out the plan of my remarks, the same subject was treated of in a very valuable paper read at the last meeting of the Eastern Association of Gas Managers by Mr. Paternoster, of Felixtowe, under the title "Retort House Working for Small Retorts," which was followed by an interesting discussion. In view of this, I was at first inclined to change my subject, but on further consideration it seemed to me that, in view of the importance of the subject, this was perhaps unnecessary, and that as my remarks must necessarily deal with the matter more from the theoretical standpoint, the two papers would, in spite of some overlapping, be complimentary the one to the other.

Shortly put, the view I wish to place before you is that next to retort temperatures, the most important point in making gas in horizontal or inclined retorts is the maintenance in the retort itself of as nearly uniform a pressure as possible, not exceeding that of the atmosphere by more than 1-tenth or 2-tenths of an inch, and it is the reason for this, and the necessary procedure to obtain it which I propose now to discuss, more especially with reference to those works where the hydraulic seal is used—this being probably the case at the majority of works with which those present are connected.

In the hydraulic main the dip pipes are sealed in the liquid contained in the main to a depth varying at different works; and this of necessity throws an additional pressure on the retort corresponding to the amount of seal used. To counteract this, the exhauster is worked in such a manner as to maintain a vacuum in the hydraulic main nearly as great as that corresponding to the depth of the seal, in order as far as possible to maintain the actual pressure in the retort only slightly above that of the atmosphere.

Taking first the most familiar and obvious points, it is well known that if a steady and uniform pressure is to be maintained in all the retorts, the dip pipes must all be sealed to exactly the same extent, the vacuum in the main above the surface of the liquid must be kept constant, and the sealing liquid should be mobile and uniform. The importance of equality of seal is well recognized, but still in many cases the arrangements are such that only a very rough approximation to this ideal is obtained. Thus, when the hydraulic main itself is supported on the brickwork of the setting, the irregular expansion of the latter brings about considerable alteration in the level of the main, with the result that some of the dip pipes are lightly sealed and others heavily sealed. Just the same result follows if insufficient care has been taken in erecting the ironwork to see that all the dip pipes are of exactly the same length and fixed in a truly vertical position, with the ends properly turned up.

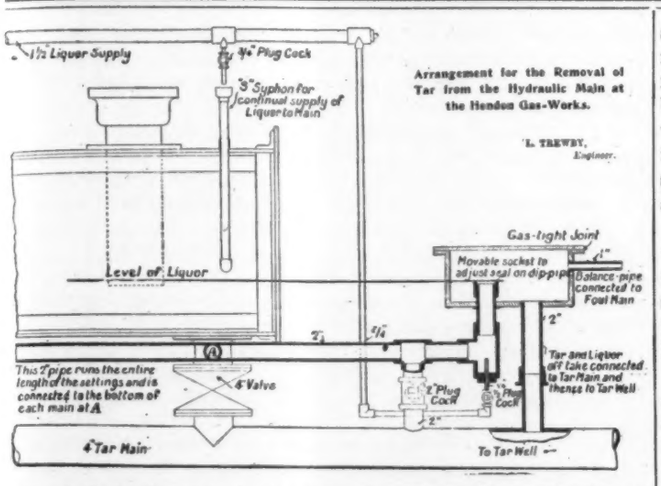
What is then the result when such a state of things occurs? Take, for example, a case in which the supposed seal is 1 inch, and a vacuum of 9-tenths is maintained in the hydraulic main, but in reality some dip pipes only have the proper 1-inch seal while others are sealed to a depth of 1½ inches and others to only ½ inch. If the 9-tenths vacuum is maintained, there will be an average pressure of 6-tenths in the heavily sealed retorts, which results in loss of gas through the porous fireclay retort, while in the lightly sealed retorts there is a vacuum, resulting in the drawing in of furnace gases from the setting, which, while it certainly increases the make, deteriorates its quality to a still greater extent. Further, when the retorts are being charged and the lids are open, air is drawn into the gas through the ascension pipe in the lightly sealed retorts, thus still further reducing its quality. Nor does the trouble stop here, for the drawing in of the hot furnace gas into some of the retorts raises the temperature of the issuing gas, bringing about increased trouble in the way of stopped ascension pipes and pitched hydraulic mains. The result of this state of things is, therefore, increased trouble in retort house working, loss of good gas on the one hand and on the other deterioration of the quality of the gas made owing to the drawing in of furnace gases and air, and in order to keep up the quality it is then necessary to lower the vacuum in the hydraulic main. This may achieve the desired result, but it is done at serious expense in loss of make, for the heavily sealed retorts now have a still higher pressure, so that more gas is forced into the setting and lost up the retort house chimney. This loss would have been quite unnecessary had the hydraulic main and dip pipes been in proper condition.

The importance of maintaining a steady vacuum in the hydraulic main is universally recognized, and a very large measure of success in this respect has been attained by the proper governing of the exhauster by means of the vacuum in the hydraulic main itself, but still greater uniformity has been obtained in late years by the use of the retort house governor—first made practicable and adopted by Mr. Chas. Carpenter, and which is now in use in many works. Recent technical literature contains many communications as to the improved working obtained where this has been adopted, the latest being Mr. Paternoster's paper already referred to, which is especially interesting as representing the results of its installation in a small works. Not only is a more regular vacuum maintained by an automatic control, but, in addition, the inevitable pulsations of pressure due to the revolving exhauster blades are also materially diminished—a matter which will be again referred to later.

A further essential for the best working is that the liquid forming the seal should be uniform and mobile, and not one varying in consistency like the mixture of tar and liquor condensing in the hydraulic main. Therefore, to attain this end, the tar must be removed as quickly as possible from the latter, leaving only the liquor to form the seal. One of the forms of apparatus used to attain this end is the Dillamore tar tower, with which most of you will be familiar; but I have recently seen another method in use, which appears to be very suitable for works of moderate size. This arrangement has been devised by Mr. L. Trewby, the Engineer of the North Middlesex Gas Company, and his assistant Mr. Allan, and by Mr. Trewby's permission I am enabled to describe their method here to-day.

The nature of the plan adopted is readily seen from the accompanying diagram. Each section of the hydraulic main is provided with the usual siphon for running in liquor to the main, and run-off pipe for emptying the main. Into each of the latter, just above the valve, a short piece of pipe is fitted, all of these being connected to a 2-inch pipe running the entire length of the settings. This latter is closed at one end, and at the other is turned vertically upwards into a special collecting chamber, until the top is approximately level with the end of the dip-pipes in the hydraulic main, a moveable socket being placed on the end to adjust the depth of the seal. This chamber is used with a gas tight cover, and is connected at the bottom to the tar and liquor main, while from the side a 1-inch pipe is connected to the foul main, to assure the pressure being equal to that in the hydraulic main.

Without some special arrangement to induce its flow, the heavy tar lying in the 2-inch pipe will not pass forward into the chamber unless the level of the liquor in the hydraulic main is an inch or two higher than the top of the pipe in the chamber. To give this necessary assistance, a small supply of liquor from an overhead tank is in-


1½ Liquor Supply
¾" Plug Cock
3" Syphon for continual supply of Liquor to Main
Arrangement for the Removal of Tar from the Hydraulic Main at the Hendon Gas-Works.
L. TREWBY, Engineer.
Gas-tight Joint
Movable sachet to adjust seal on dip-pipe
Balance-pipe connected to Foul Main
Level of Liquor
2"
2½
1¼
Tar and Liquor off take connected to Tar Main and thence to Tar Well
This 2" pipe runs the entire length of the settings and is connected to the bottom of each main at A
6" Valve
1" Plug Cock
1" Plug Cock
2"
4" Tar Main
To Tar Well

troduced through a ¼-inch pipe into the 2-inch pipe just where it turns vertically upwards; and this liquor stream, entering with considerable velocity, acts as an injector and draws the tar away from the hydraulic main as it settles to the bottom, and causes it to flow continuously with the liquor to the tar well, without any necessity for running it off periodically by hand as is the case with the Dilla more tower.

Mr. Trewby finds that so long as a constant and sufficient head of liquor is maintained in the tank supplying the "injector," no appreciable quantity of tar can be found at any time in the mains, and that since the introduction of this plan, not only has there been no trouble with tar in the mains, but he has also been enabled to maintain a very steady vacuum in the hydraulic main and retorts. The best plan to insure a steady head of liquor is to pump the latter into a tank placed well above the hydraulic main level and to keep this always full to the overflow; the same tank serving, of course, for the supply of liquor direct to the hydraulic mains through the siphon provided for the purpose.

The importance of these three points—uniform depth of seal, regularity of vacuum and uniformity of the liquid forming the seal—for good carbonization, is universally admitted. The question I want now to consider is whether the maintenance of these conditions alone, essential as they are, is in itself sufficient for the attainment of what after all is their ultimate object—namely, to insure a constant and even pressure in the retort itself, and to this question I think the answer is in the negative. That this is so, anyone can see by putting a pressure gauge on the retort mouthpiece itself, when it will be observed that, even though the hydraulic main vacuum is quite steady, the pressure in the retort is not constant, but is rapidly pulsating or oscillating, changing from pressure to vacuum and from vacuum to pressure every few seconds.

The cause of this oscillation of pressure lies in the bubbling of the gas through the seal; for as the gas comes out of the end of the dip pipe under the liquor it first forms a bubble at the end, which depresses the liquid in the main, thus temporarily increasing the pressure in the retort. As the bubble breaks, this extra pressure suddenly ceases and a vacuum may follow in the retort, and this change keeps on every few seconds as long as the gas is coming off. If the extent of this pressure oscillation is considerable, as it certainly very often is, results detrimental to good carbonization at once follow; for during the pressure period coal gas tends to escape through any cracks in the retort into the setting, while during the vacuum period furnace gases are drawn into the retort in a similar manner. Even if the retort is fairly sound so far as cracks are concerned, this alternation of pressure and vacuum has a deleterious effect, for the fireclay material of the retort is porous, and during the pressure period some of the gas is forced into the pores of the retort, and though before it has got through into the setting it is drawn back again by the succeeding vacuum, it has in the meantime been in contact with an immense surface of highly heated solid matter. This is the best condition that can be brought about to promote the formation of carbon on the retort and to break up the tar vapor into denser products, which increase the worries of stopped pipes and pitched hydraulics.

Now the extent of the pressure oscillation caused by the bubbling of the gas through the liquid seal depends on many different circumstances; increase in the diameter of the dip pipe increases the extent of the oscillation, and so in a very marked manner does increase of the depth of the seal. It is not, therefore, as is sometimes supposed, a matter of indifference how great the depth of seal, so long as a correspondingly increased vacuum is maintained in the hydraulic main; for although the average pressure in the retort will be the same in both cases, the extent of the deleterious oscillation of the pressure will be much greater with the heavier seal, and it is a familiar fact in every-day work that when a retort is found to be more heavily sealed than the others carbon is deposited in it more rapidly and the ascension pipe stoppages are much more frequent.

This matter of the oscillation of pressures in the retort itself, though well known to many, seems to have been but little considered in technical literature, but it was discussed in a very able paper read some 31 years ago before the North British Association by that master in the principles of carbonization, the late Mr. William Young, of Peebles, and I cannot do better than refer you to this paper.

There is, also, a further point affecting this oscillation to be considered—namely, the character during actual working of the surface of the liquid in the hydraulic main. This is far from being the true horizontal surface we depict in our sketches, but is much more like that of a storm-tossed ocean, the surface being covered with rapidly moving waves, so that the dips are sometimes sealed in the crest and sometimes in the trough of the waves, thus further increasing the amplitude of the oscillation of pressure in the retorts. Moreover, the heavier the seal the more violent is the commotion caused by the bubbling, resulting in higher waves on the surface of the liquid, so that in this respect, also, increased depth of seal is disadvantageous.

All these things tend to happen, even when the obvious conditions mentioned above are fulfilled. If this is not the case and the dips are unequally sealed, or some sealed in tar and others in liquor, or if the hydraulic main vacuum is unsteady, the extent of the oscillation is enormously increased, and I have known this under unfavorable conditions to be measured in inches and not in tenths, with disastrous results both in loss of gas from the retorts and in the drawing in of furnace gases and air into the gas- On the other hand, where good carbonizing results are being obtained, I have often found the oscillation of pressure in the retort itself not to exceed 1-tenth or 2-tenths of an inch.

The particular moral to be drawn from these considerations is that it is necessary, for good carbonization, to keep the seal as light as possible consistent with safety and the avoidance of sucking in air through the dip pipe during charging. Light seals of about half an inch can, however, only be worked when the dips have been carefully levelled and the hydraulic main vacuum is very even, and it is partly by reason of this that I think the retort house governor has proved so successful, as not only does it maintain a better average vacuum, but it also largely eliminates the pulsations due to the working of the exhauster and prevents these reaching the hydraulic main, thus rendering lower seals possible.

It is also advantageous to try and reduce the oscillation by making the evolution of the gas from the seals take place in as small bubbles as possible. One method of doing this is to turn the end of the dip pipes to a knife edge instead of leaving them square; the sharp end causing the bubbles to break much more quickly. Mr. Leslie Cloudsley and I have suggested another method of doing this, applicable to existing dips without removing them. It is a modification of the old serrated dip, and consists in placing inside the dip pipe a sheet iron sleeve, having at its end square serrations, which is fixed so that these serrations only come just below the bottom of the dip, thus causing the gas to pass out through these in a series of small bubbles. The sleeves being only fixed lightly inside the dip can at any time be readily removed for cleaning if necessary.

I have mentioned the disadvantage brought about by the agitation of the liquid in the hydraulic main, inasmuch as this increases the oscillation of the pressure in the retort; but it is only fair to point out that this is not in every way a disadvantage. Mr. James W. Helps, of Croydon, has pointed out to me that, although the agitation of the surface is objectionable, the fact that the whole body of liquid is in motion is of great assistance in helping away the thick tar from the hydraulic main and preventing its accumulation there, and he has found in some cases that where by careful attention the agitation of the liquor has been greatly reduced, trouble from accumulation of tar has followed. From a study of different hydraulic mains, Mr. Helps finds that shape makes a great deal of difference in this respect, and that with some sections it is possible to get a good washing action from the motion of the body of the liquid as a whole even while the surface is kept fairly uniform and free from waves, and that in others the reverse is the case. This is an extremely interesting point,

and shows how in carbonization matters which at first sight appear quite unimportant may materially affect the working.

From what has been said, it will be seen that the hydraulic main, useful as it is in forming a convenient and automatic non-return valve, enabling the retort to be opened safely at any time, nevertheless brings many disadvantages in its train, and all the precautions mentioned to-day, with the exception of the maintenance of a steady vacuum, are necessitated by the use of the liquid seal. The question naturally arises whether it would not be better to do away with the seal altogether and use a dry main with suitable non-automatic valves for shutting off the retort during the charging interval. As you know this forms a very old controversy. I do not propose to enter into it now, as for one thing time will not permit, and for another I cannot speak here from personal experience, for I regret to say I have no practical knowledge of the working of dry mains. But at the same time, I feel convinced that the last word has not yet been spoken on this subject, and there is much to be said in favor of the method, especially where the tar produced is not too viscous and heavily loaded with free carbon.

Returning to my text, I would like in conclusion to emphasize once more the importance of watching the pressures existing in the retorts themselves, and of making every effort to obtain these as constant as possible. I know full well the difficulty there is for the manager of a small works especially, to find the necessary time for attention to these matters—occupied as he is with so many other duties; but nevertheless I believe that the time so spent will be amply repaid, not only in improved results, but also eventually in economy of his own time, by reason of the resulting easier working in the retort house itself, owing to the diminution of the troublesome epidemics of stopped pipes, thick tar in mains, etc., which occupy such a large portion of his time, and often at the period when he can least spare it.

Integrating Photometers.

Dr. Hugo Krüss, of Hamburg, recently prepared an article on this subject for the "Journal für Gasbeleuchtung," for an abstract translation of which we are indebted to the *Journal of Gas Lighting*.

The Ulbricht spherical photometer is in the truest sense an integrating photometer. The illuminating intensity shown in the observing window of this apparatus is proportional to the whole of the light emitted by a source of light placed in the sphere. It, in fact, sums up the illuminating power emitted in all directions; but the application of this sphere is greatly hindered by the fact that for large sources of light the sphere must be of comparatively large dimensions, so that it cannot well be set up in the limited space of an ordinary photometer room. It is generally accepted that the greatest want of uniformity in the light emitted from a source is in the vertical plane. It is customary to be content with making measurements in different directions on this plane. But if there is great want of symmetry in the light emitted in the horizontal plane through the source, measurements are made not only in the single meridian plane, but in several. For these measurements one mirror or a series of mirrors, which reflect the light emitted in any one direction on to the photometer disk, are used. Determinations are thus made in a great number of directions of the semicircle, or of the whole vertical circle, by moving the mirror in turn to the necessary positions. The final result, which expresses the mean hemispherical or spherical illuminating power, is deduced by calculation from the results so obtained. By this method, single measurements in different directions give the important information as to the polar curve of the light radiation from the source.

The simplest of these devices is a single mirror as first employed by Hefner-Alteneck. A mirror S (Fig. 1) is placed at the side of the source of light L, at such an angle to the photometer axis LP that it reflects the light of the source L on to the photometer disk P. The mirror can be brought to different positions about the photometer axis, so that the intensity of the light can be measured in different directions in the vertical plane through the source of light. If the mirror could be rotated very rapidly, it would be possible to obtain the mean intensity in this vertical plane by a single measurement. Brodhun has used such a method for determining the mean horizontal illuminating power of electric glow lamps; but with very powerful sources of light, the circle of rotation would be so large that the method could scarcely be employed. Hence a number of mirrors fixed at distances of (say) 15° or 10° on the circle have been substituted for the single rotating mirror by, among others, Blondel and Matthews. By such a circle of mirrors the sum of the intensities of light in 24 or 36 different directions is measured on the photometer screen. On dividing the result thus arrived at by the number of mirrors, the mean vertical illuminating power of the source is obtained; but to get the mean spherical illuminating power, the measurements must be made with the circle of mirrors in different horizontal directions, and the mean taken, unless the light radiated in all directions of the horizontal plane happens to be uniform.

The mean spherical illuminating power is not, however, forthwith obtained by this method, as will be seen from the following considerations: In Fig. 2, A is the source of light and AB the vertical axis through it. If C and D are the positions of two mirrors, then the angle $CAD = \beta$ is a measure of the interval between them. Then if r is the radius of the circle of mirrors and α the angle which the line AE, which bisects the angle β, makes with the horizontal, and I_α the illuminating power in the direction α, the illumination on a unit of the circle is $\frac{I_\alpha}{r_2}$. Then I_o being the mean spherical illuminating power, the sum of the measurements I_α in different directions should be equal to I_o. But it may be demonstrated geometrically that the values I_α must be multiplied by cos α in order to make their sum equal to I_o. Consequently a circle of mirrors for the determination of mean spherical illuminating power must have a device which takes account of the factor cos α; and it is these devices which constitute the difference between the various circles of mirrors devised by different photometrists.

Blondel inclosed the source of light in an opaque sphere which had horizontal slits at distances corresponding to the distances of the mirror in the circle from the equator. The length of the slit is proportional to the factor cos α. If the sphere is rotated about its vertical axis so rapidly that there is no flickering, evidently the single mirror gives quantities of light proportional to cos α. Bearing in mind that the slits near the equator only make up a small part of the surface of the sphere, it follows that this apparatus causes considerable diminution of the light. The rotation required also makes this form of Blondel photometer both complicated and costly. Matthews uses two mirror half circles placed at right angles to one another, with their center at the same height. In the center of one half-circle the source of light is placed, and the mirror of this half-circle reflects the light on to the mirror of the second half-circle, which is in front of the other, whence it is projected to the center of the second half-circle, where the disk of the photometer is placed. The rays thus strike the disk at the angle corresponding to that of the mirrors. According to Lambert's law, the intensity of illumination of a surface is proportional to the cosine of the angle of incidence, and the factor cos α is known. The fact that Lambert's law is not strictly applicable to large angles of incidence is overcome by Matthews in this manner: The distance of every two co-operating mirrors of two circles, which thus form an angle of the mirrors and are closely joined, can be corrected from the center of the circles within certain limits corresponding to the deviation from cos α.

In a circle of mirrors intended for testing arc lamps at the Electrical Testing Laboratory in New York, Matthews has taken account of the factor cos α by introducing a smoked glass in the line of each ray of light. This glass, by absorption, reduces the intensity of the light in the ratio of the cosine of the angle of the particular mirror. This arrangement has the advantage that the circle of mirrors does not bring together the light emanating from the source until it reaches the photometer disk if the latter is set up at a particular distance from the circle dependent on the inclination of the mirrors. Equality of illumination of two sides of the photometer disk is obtained by moving the sources of light and not by moving the disk. Moreover, the factor cos α is not taken into account in a very simple manner. The Matthews circle of mirrors is not truly an integrating photometer. The author proceeds to describe a modification of it. There is a semicircle of a number of small mirrors, at the center of which the source of light is placed. One of these mirrors (S) is shown in Fig. 3 in relation to the source of light (L). The semi-circle can be set up either vertically or horizontally, and a complete circle may, if desired, be used instead of it. The mirrors project the light from the source on to a number of object glasses (O) disposed to one another in the same way as the mirrors.

These object glasses throw the images of the source of light on to a matt-surfaced disk (M), which is placed parallel to the plane of the circle of mirrors. These images are all superimposed so that the total radiation of light in different directions is obtained. The images, however, are not equally sharp in all parts, as the disk is not at right

angles to the optical axis of the object glass. This, however, does not matter in the present case, as it is only the illumination of the disk, and not a sharp impression, that is required. The intensity of illumination of this disk is determined on a bar photometer. In front of each object glass there is a screen (*b*), the area of the opening in which is proportional to the cosine of the angle, which is that of the mirror corresponding to the object glass. Thus the brightness of the images of the source of light produced by the object glass is degraded according to the value of cos *a*. Means are provided for rotating and adjusting the screens. In determining the mean spherical or hemispherical intensity, a factor must be introduced for the loss of light in the mirrors, object glasses, and matt-surfaced screens. The apparatus admits of any object glasses being cut out by shutting the corresponding screen. Thus measurement may be made with only one object glass, and the polar curve of the light radiated by the source may thus be determined.

It is very important that the matt-surfaced disk should be of the proper material. Ground or etched glass lets a considerable amount of the light through, so that the photometer measures the light directly. transmitted, as well as the illumination of the disk. Moreover, the rays strike the disk at an angle of about 20° to the perpendicular Experiments showed that a finely etched glass plate gave 3 per cent. of the illumination at this angle, and a coarsely ground glass plate 13 per cent. Consequently such glass must not be used, but only milk glass, which does not transmit light, and so can be used in photometry simply on the basis of the law of the decrease of illumination with the square of the distance. But milk glass absorbs much light; and, consequently, apparatus in which it is employed can only be used for high power lights. It is easy, however, by a small change of the optical part of the apparatus, to substitute for the disk *M* the actual disk of the photometer or the milk glass plate of the Weber photometer. For this purpose a system of lenses must be used as shown in Fig. 4. The lens *P* produces an image of the source of

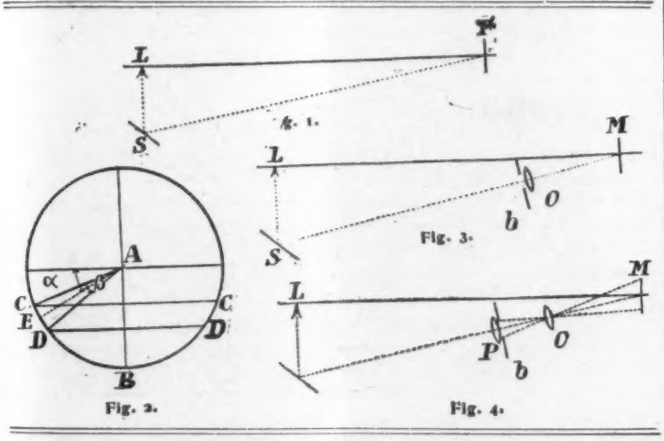


Fig. 2.

Fig. 3.

Fig. 4.

light *L* in the principal axis of the object glass *O*, which is of such diameter that it can receive the whole image. Immediately behind the lens there is a screen *b*, the area of the opening of which is proportional to the cosine of the angle *a* of the corresponding mirror. This screen thus makes the light used proportional to the factor cos *a*. The total length of the object glass *O* is such that it projects from the opening in the screen an image of a particular size at *M*. If lenses corresponding to *P* and *O* are similarly introduced for all the mirrors, then the images reaching the plane *M* will all have the same size. The surface illumination of each of these images is the same at all points, and, consequently, that of the sum of the superimposed images is the same also. Therefore, the disk in the position of the plane *M* may be that of a Lummer-Brodhun photometer, or of a Weber photometer, and the measurement may be made in the usual way. The constant of the apparatus may be determined by using a source of light of which the mean spherical illumination has been already ascertained. It may be assumed that the loss of light is alike in all the elements of the apparatus, and thus the one constant will apply whether the measurement being made is of the light radiated in a single direction or over a large angle.

THE Massachusetts Board of Gas and Electric Light Commissioners is comfortably going on with its work in its new quarters. Possibly the Commission will in *time* have a structure of its own.

Electrical Generating System of the Newton (N. J.) Gas and Electric Company.[1]

Newton, N. J., has a population of about 5,000. It is situated on the Sussex Division of the Delaware, Lackawanna & Western Railroad, and is within commuting distance of New York city. A number of small but thriving industries are located in Newton, and it possesses both a gas and an electric service. The electric and gas systems are owned by the Newton Gas and Electric Company. The town has no electric service during the day and the maximum load at night does not exceed 250 kw. The station, however, is an interesting one, because the prime movers are producer-gas engines, which are belted to 3-phase alternators. There are about 250 customers connected with the company's lines and although the load is chiefly residence lighting, the net earnings are about $6,500. The cost of generating electricity is 1½ cents per kw.-hour at the switchboard, and the maintenance cost is 0.0026 cent per kw.-hour delivered. The initial cost of the station and equipment was $33,000.

The power house is situated on the outskirts of the town immediately adjoining the gas works. This arrangement not only serves to concentrate the company's properties, but in case of mishap to the producer gas equipment makes illuminating gas available for use in the gas engines. The equipment comprises one 100-horse power and one 200-horse power producers, both of which are capable of furnishing a gas having a calorific value of 135 B.T.U. per cubic foot. The engines, which are rated the same as the producers, require approximately 82 cubic feet of gas per brake horse power hour, producer gas, of course, having a much lower calorific value than illuminating gas.

The engines are belted to a 75-kw. and a 150-kw., 2,300-volt, 60-cycle, 3-phase generator; the electrical output is controlled by a 10-panel switchboard of standard design. The inclosed arc lamps used for public lighting are fed with energy from two 50-lamp, constant current transformers. There are approximately 8½ miles of electric circuits in the town. Secondary 2 × 110-volt circuits are used for local distribution from pole line transformers. The 3-phase circuit is split into three individual circuits. Two of the single-phase circuits are used for the tub transformers and the remaining circuit carries the incandescent lighting load. The phases being out of balance on peak load, a Tirrill regulator is used to regulate for fluctuations in voltage on the phase feeding the incandescent lighting circuits. The public lighting load comprises 90 series inclosed, 6.6-ampere arc lamps and 18 series incandescent lamps fed with energy from the same series circuits.

The gas engines are of the American Crossley type built by the Power and Mining Machinery Company, and the producers are of the Crossley suction type, using anthracite peel coal costing $3.50 a ton delivered at Newton. The hoppers hold 75 pounds of coal and at regular intervals of 2½ hours the producers are charged with as many happerfuls as are required to fill them. The producers are fitted with shaking grates for breaking up and forcing through the clinker, so that the fuel bed is easily kept clean. At the end of the night's run the ashes are removed.

Above the fuel bed is a saturator, communicating with the interior of which four are air valves. The latter serve to admit air which mingles with the steam generated in the saturator and passes down through suitable pipes to an air box which surrounds the producer just above the level of the grate. The air box is arranged so that the air as it comes down is discharged at the opposite side of the box, through which it is required to pass half-way round. The air as it emerges mingles with a supply of fresh air admitted through a primary air pipe and passes up through the bed of incandescent fuel to the scrubbers. On its way through the bed of fuel the air takes up carbon and is converted into a combustible gas before it reaches the scrubber.

The first, or wet scrubber, consists of a cylinder filled with coke, over which water trickles. The gas from the producer is caused to pass downward through this scrubber and up through a similar arrangement on top of which is a dry scrubber; the filling for the latter consists of excelsior, sawdust or shavings. After passing through this scrubber the gas goes to the engine. The circuit of air through the fire and scrubbers is caused by the suction of the engine; a vacuum of 6 inches on the water gauge is produced by this means in the pipe leaving the dry scrubber.

A purge pipe is provided for permitting the gases to escape when

1. *Elec. World.*

Fig. 1.—General View of Gas Engine Driven Generating Units and Switchboard.

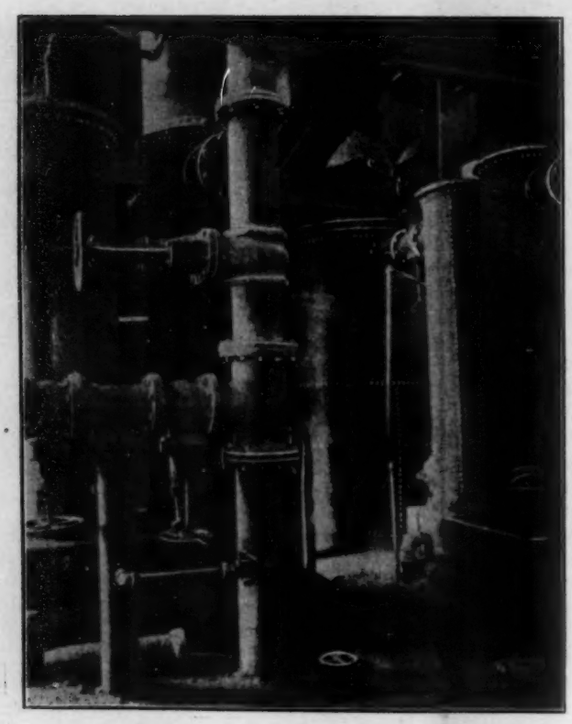


Fig. 2.—View of the Gas Producers.

the fire is started in the producer. A fan in the primary fresh air supply line is used in kindling the fire quickly. If insufficient steam is present in the air from the saturator, the gas will not be rich enough in hydrogen and clinker will result; while, on the other hand, the pressure of too much vapor will give a gas too rich in hydrogen and the fire will suffer from the excess of moisture. It is possible to regulate the amount of steam generated in the saturator by governing the amount of water circulating over it.

The larger gas engine is fitted with two cylinders opposed on a single crank. The smaller engine has a single cylinder. A Rites governor is employed to regulate the speed. Secondary cam shafts are fitted to the side of the engine. These are driven through spiral gears from the main shaft. The gas and air valves are operated from

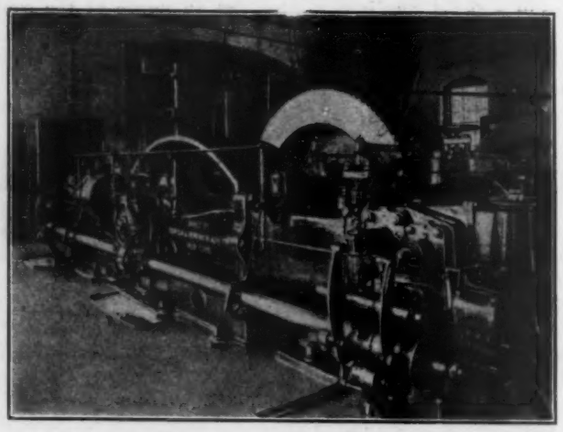


Fig. 3.—Near View of Gas Engine.

the secondary shaft through cams and rocker arms. A grid-iron valve controlled by the governor cuts off the supply of explosive gas from the main admission valve at all loads above one third full load. The main valve is of the mushroom type and opens and closes so as to give maximum admission at all times. At all loads below one-third full load the governor regulates on the hit-and-miss principle. The exhaust valve is water cooled.

A magneto driven directly from the end of the cam shaft is used to furnish the electrical energy for ignition purposes. Lubrication is effected by a force-feed lubricator driven from the cam shaft.

The lamps used in the 250 residences connected to the company's circuits are rated chiefly at 16-candle power and 8-candle power. These are renewed free of charge. Tungsten lamps rated at 100 watts are sold at the rate of $1.75 each, and the customer pays for renewals. There are also a number of Nernst lamps connected to the circuits.

All customers receive their supply of energy through meters. The rates for residence service range from 15 cents to 8 cents per kw.-hour, depending on the quantity used. Stores requiring over 100 kw.-hours are lighted at 8 cents per kw.-hour, and the bill is subject to a discount of 3 per cent. for prompt payment. Illuminating gas sells at $1.60 per 1,000 cubic feet for straight lighting; $1.45 for combination service, and $1.20 for fuel service. In many of the residences use is made of gas for cooking and electricity for lighting. Although there

are about 700 gas customers to 250 electricity consumers the incomes from two are about equal.

No solicitors are employed to search for business, but advertisements are carried in all the papers and dodgers are distributed from time to time announcing the appearance of some new device, etc. The company does a wiring business and the installations are made at cost of material. Ninety per cent. of the wiring is knob-and-tube work, while the remaining 10 per cent. is conduit work. The wiring is done in accordance with Code requirements; the average cost per outlet on knob-and-tube work is $1.80. All distribution wires being overhead, the service entrances are also overhead. An emergency motor service is installed in the local silk mills, the load aggregating 50 horse power. This service, of course, is available only at night, but advantage has frequently been taken of the emergency connection by the mill owners for night work. The summer load on the station averages 190 kw. The electric lighting lines do not extend beyond the town limits.

Is Supplying Electricity a Natural Monopoly?

In answering this question *Illuminating Engineer* ardently says: Of all the bugaboos paraded by demagogues and theorists to frighten the innocent public, the word "monopoly" stands at the head. Even admitting for the sake of argument that almost all monopolists are devils, they may not be as black as they are painted. It has perhaps never occurred to many that the reputation which America has justly earned of surpassing all nations in inventive genius, as well as the phenomenal development of our manufacturing enterprises, is to a very large extent the result of monopoly guaranteed by the government, familiarly known as patent right. To everyone, native or foreign born, who has discovered "a new and useful" idea of any kind, our government will guarantee an absolute monopoly in the use of that idea for a period of 17 years.

The carrying of the mails is an enormous business which is absolutely monopolized by the government, from which it is reasonable to infer that there are some things at least, which may be justly called "natural monopolies." Such monopoly may be co-extensive with the entire country, or it may be only of local application. The telephone offers another example; there is no doubt that a single telephone system giving good service at fair rates is more satisfactory than two or more competing systems.

A recent decision by the newly created Public Utilities Commission of New York State in refusing to authorize the establishment of a competing electricity supply concern, or central station, in New York city, brings up the question whether or not the public supply of electric current is a natural monopoly.

For a number of years a single company has controlled the entire supply of New York city. Recently another company, having powerful financial interests back of it, wished to enter the field; but before being able to proceed it was necessary to obtain the consent of the Commission to issue its stocks and bonds. After a full investigation and hearing upon the matter, the Commission decided that a competing company was not needed. Although some technical objections were cited in the opinion, the real reason for the decision was the fact that the company was not needed. Against the argument that competition would bring down the price of current and insure better service, the Commission answered that it had ample power in itself to reduce the present rate charged by the monopolistic company if assured if such reduction would not reduce the profits below a reasonable figure, and to make such regulations as would insure proper service. It also pointed out that there was no possible means of preventing the proposed competing company from sooner or later falling into the hands of the present company, and so ending the competition with the advantages claimed for it.

Taking the purely business view of the matter, we believe that most people would agree that a single lighting company making fair and indiscriminating rates, and furnishing reasonable and proper service, would be on the whole more satisfactory than two or more competing companies, each striving to work out its own salvation—or destruction—with a free rein.

The Commission calls attention to the very important fact that, even though the company seeking the franchise might be actually a competitor at the beginning, there was no power on earth that could prevent its final consolidation with the present company. The great engineer, Stevenson, uttered one of the most profound axioms in political economy ever enunciated when he said that, "Where combination is possible, competition is impossible." Neither unrestrained competition, nor public ownership, nor public supervision, is ever going to enable the public to get something for nothing. Competition may temporarily reduce prices, even below the profit line, but in many cases reprisals taken. This is particularly apt to be the case with competition in public utilities. Greed is a natural and within certain limits, a necessary characteristic of human nature, and the corporation, like the individual, may be counted upon in the long run to secure every advantage for itself that it safely can. In the case of corporations dealing with public utilities, therefore, the necessity for some means of restraint is a necessity, if a fair balance between those served and those serving is to be maintained.

The question whether such restraint can be most effectually accomplished by the commercial warfare known as competition, or by means of government authority, local or otherwise, is one which can only be answered by actual experience. One thing is reasonably sure: unrestrained monopoly of public utilities is nearing its finish in this country. Competition as a regulative force has been fairly well tried out, and it was perhaps a wise action on the part of the Commission to give government regulation a chance to show what it could do. If the Commission will exercise its powers fairly, but vigorously, and if the corporations which enjoy monopoly by virtue of this Commission are sufficiently far seeing and broad minded not to overreach themselves, but show a genuine disposition to give as good service as possible consistent with reasonable profits on a capitalization that is not too palpably aqueous, there will be no serious public protest against their monopoly. But the whole outcome will depend upon the "if's." If the Commission becomes infected with politics, and allows its enormously powerful influence to become an article, a political barter, either unrestrained competition or some more drastic measure will be taken to safeguard the rights of the people.

Lackawanna Steel Sheet Piling.

Iron Age notes that a new form of steel sheet piling is now manufactured by the Lackawanna Steel Company, Buffalo, N. Y., each piece being complete in itself as it comes from the rolls and requiring no fabrication. The piling is a special rolled, one-section bar, consisting of a web portion with flanges of like form at each edge, adapted to engage with similar flanges of an adjacent section. Each pile interlocks with the one previously driven. As shown in Fig. 1, the shorter flanges of the new pile are hook shaped and engage with the corresponding hooked flange of the adjacent section. The longer flanges are shaped to form a guard around the hook of the adjacent section.

When the piling is driven the hooked flanges prevent longitudinal displacement, while the guard flanges prevent lateral displacement, and assist to prevent longitudinal displacement of the sections. The joint has 3 points of bearing which produce a positive and double interlock, offering in a built up wall a rigid resistance to the strain such a wall is subjected to, particularly the longitudinal strain, and the side or buckling strains. At the same time this interlock, with a bearing on both sides of the web, holds the piling in line while being driven, and the result is a straight wall.

Before these sections were offered for general use, an experimental cofferdam was driven with 32-foot lengths of 12¾-inch sheet piling. The material inclosed was subsequently excavated in order to ascertain the condition of the piling ofter driving. It was found that the interlock was perfect, and that the joints were practically watertight.

The average of tests conducted to determine the strength of the interlock showed that with two 12¾-inch sections interlocked the joint has in tension a value of 9,700 pounds per linear inch of bar. Ability to turn various angles and still maintain a perfect interlock is also a feature of this bar, the shape of the interlocking flanges and hooks permitting a change in direction with a line of piling in case boulders are encountered. When these piles are driven in clay or quicksand, enough of the soil works into the joints to make them practically watertight.

If driven in clear water the usual methods of packing, if necessary, may be employed to produce a watertight joint. The friction area in the interlock being 3 narrow surfaces, is at a minimum, so that the piling can be driven and withdrawn a number of times, and when it has outlived its usefulness the discarded material can be sold for scrap. The following table shows the standard weights and widths of sections rolled:

A. Thickness of Web. Inches.	Weight per Square Foot of Wall. Pounds.	B. Distance c. to c. of Joints. Inches.	Weight per Linear Foot. Pounds.	C. Width of Joint Over All. Inches.
½	40.00	12¾	42.500	3¼⅝
⅜	35.00	12¾	37.187	3¼¼
¼	19.70	7	11.500	1¾¾

An ordinary pile driver is used, the head of the piling being fitted with an iron cap having a wooden cushion interposed between the iron cap and the hammer of the pile driver. In driving, satisfactory results have been obtained in keeping the vertical alignment of the bar.

This is especially important where a long wall is driven and long lengths are used. In the closing of rectangular pockets the vertical alignment must be true, so that the closing pile may drive freely for its full length and not strain the interlock.

Fabricated corners are formed, as in Fig. 2, by fitting the edges of two half sections at the desired angle by means of structural steel angles. Junction members for cross walls are made up of a full section, a half section and two angles riveted together. Both styles of fabricated corners are shown.

The 12¾-inch Lackawanna bar has been adopted for the construction of the cofferdam for the new government ship lock in Black Rock harbor, Niagara river, at Buffalo, N. Y. This will be one of the largest ship canal locks in the world. About 7,000 tons of piling will be required for the complete cofferdam—the largest single order of this sort ever placed for government work. The cofferdam is 947 feet long, 245 feet wide outside dimensions at one end, and 250 feet at the other end, and requires lengths of 44 feet to 50 feet of piling. The wall of the cofferdam is made of two lines of piling 30 feet apart, with division walls at 30-foot intervals, forming 30-foot pockets. Later these pockets will be filled with clay to form the solid wall of the cofferdam.

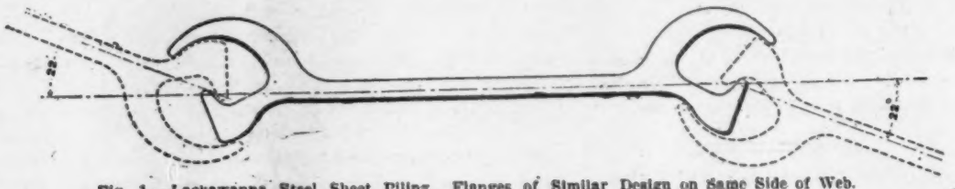


Fig. 1.—Lackawanna Steel Sheet Piling. Flanges of Similar Design on Same Side of Web.

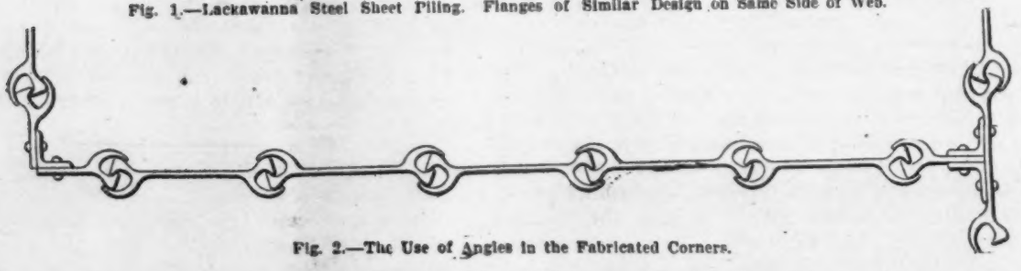


Fig. 2.—The Use of Angles in the Fabricated Corners.

Improvements in Luminous Arc Electric Lamps.

A patent for a composition electrode for luminous arc lamps has been issued to Mr. G. M. Little, of Pittsburg, Pa., on June 9, as illustrated in Figs. 1, 2 and 3. The anode shown in Fig. 1 is composed of a rod of iron having longitudinal radial slots in which strips of copper are placed. This anode is used with a so-called magnetite cathode composed of a mixture of magnetic oxide of iron which is a conductor both when hot and when cold and which gives conductivity to the electrode, oxide of titanium which imparts appropriate color and brilliancy to the arc, and oxide of chromium which steadies the arc and prevents the electrodes from being rapidly consumed. Such a cathode has usually been employed in combination with a copper positive electrode which is very slowly consumed.

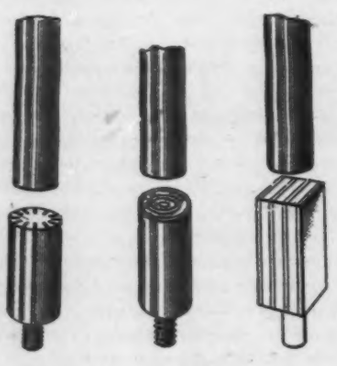
In operation with a copper anode of the lamp there forms on the anode a slag that is composed of the oxide of copper, a very poor conductor when cold, which prevents electrical contact between the electrodes and consequently interferes with the ready starting of the lamp after it has once been in use. For this reason it has been proposed to employ iron for the positive electrode or some other metal, the oxide of which is a conductor. Iron, however, is more rapidly consumed than copper and what has been termed "pooling" frequently occurs when it is employed; that is, the arc plays upon a comparatively small portion of the end of the composition electrode until the surface becomes hollowed and a depressed pool of the molten oxide forms, upon which the arc moves rapidly, resulting in flickering of the light.

With the anode illustrated in Fig. 1, and the modification shown in Figs. 2 and 3, it is claimed that pooling does not occur and that consequently a steady arc results. The rate of consumption of the electrode is also considerably less than that of iron alone, and it has been found that, if the larger portion of the exposed area is composed of iron, the life of the electrode may even be greater than that of copper alone, the iron serving as mechanical means for preventing scaling of the oxide that forms upon the surfaces of the copper unexposed to the arc, thereby preventing continued oxidation of the copper.

Experience shows that unless special means are provided for ventilation of luminous or flaming arc lamps the solid matter emitted by the arcs in the form of smoke is deposited upon the inclosing globe, thereby forming a coating which obscures the light to a greater or less extent.

On July 7th a patent was issued to Dr. C. P. Steinmetz for an arrangement by which the solid matter is directed away from the air inclosing globe and is then removed or eliminated from the air currents which carry it.

The arc which is formed between the electrodes is surrounded by a small inclosing globe open at its lower end as indicated in Fig. 4. The interior of this arc inclosing globe communicates with the interior of a chamber 4 formed between the plates 1 and 2 and the cylindrical casing 5, this communication being afforded by means of a suitable number of openings in the lower plate. The arc inclosing globe 26 is in turn sur-



Figs. 1, 2 and 3.—Anode for Magnetite Lamp.

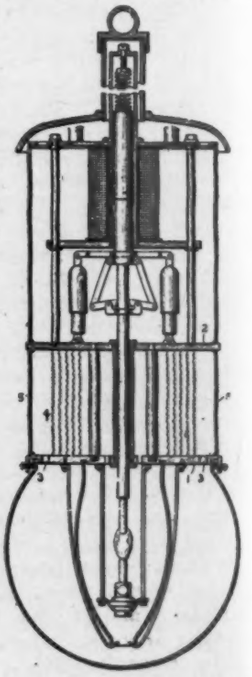


Fig. 4.—Steinmetz Ventilated Lamp.

rounded by a spherical or other suitably shaped outer globe. When the lamp is in operation the arc heats the air immediately surrounding it and this air rises through a set of openings into the chamber formed between plates 1 and 2, thereby producing a draft up through the opening at the lower end of the inner arc inclosing globe. This draft causes air to be drawn from the chamber 4 through suitable openings, some of which are indicated at 3, down into the outer globe. The action described causes a continuous circulation of air from the inner arc inclosing globe up into the chamber 4, then down from the chamber into the inclosing globe and from thence into the inner inclosing globe, and so on. This directed circulation of heated air from the arc permits the removal of solid matter emitted from the arc almost as soon as it is produced and for this purpose use is made of a series of screens formed of wire gauze of moderately small mesh, these screens being located concentrically in the chamber 4. In the drawings these screens are indicated in cross section, and as shown it will readily be seen that the air which is caused to circulate by reason of the heating action of the arc is forced to pass through these screens before returning to the chamber formed between the inner and outer globes. The solid matter given off by the arc in the form of smoke or vapor is thus deposited in the meshes of the screens, thereby preventing its deposition upon the arc inclosing globe, the effect of which would, of course, be to reduce seriously the amount of light transmitted.

Illumination and Our Eyesight.

Engineering, in discussing this problem, notes that if past generations spoilt their eyesight by working in insufficiently lighted rooms, we have now to guard ourselves against too much light. We need not go back a generation, in fact. We all remember, and know still, the sooty oil lamps, and the unsteady gas lamps of trains and omnibuses; but it is more by contrast with the intense electric lamps that we find in most of the places and conveyances in which we dwell, work and travel. Brilliant illumination has become the fashion. Many of us do not mind strong light; some complain particularly about the glare of the incandescent filament and of the arc. All of us are probably ready to admit that the intense light may have slow, lasting effects, from which we will have to suffer in the course of time. But when it comes to specifying what kind of light we object to, we have to confess that we have hardly any experimental basis for our objections.

The introduction of the powerful electric incandescence lamps fitted with metalic filaments has strengthened the complaints, and the lamp manufacturers are anxious to meet the objections. The question came up before the annual meeting of the German electrical engineers, the Verband Deutscher Electrotechniker, held at Erfurt this summer, in connection with an eagerly discussed paper by Fr. Schanz, M.D., and C. Stockhausen, Dr. Ingenieur. These gentlemen regard the ultra-violet rays as the source of danger, a belief which is certainly shared by many others, and they point out that with the improvement of our lamps we have been receiving more and more ultra-violet rays. The spectrum of the light of a paraffine or wax candle, and of an ordinary rape-seed oil wick, is hardly longer than that of the visible rays. When the combustion is rendered more energetic by the aid of a chimney, the ultra-violet rays increase. In the incandescent gas light, in the electric and Nernst lamps, and particularly in the mercury arc, ultra-violet rays abound. These differences are masked to a certain extent when we surround the sources of a light with glass shades; for the glass absorbs a good many rays, especially those of wave lengths smaller than 300 $\mu\mu$. But some ultra-violet rays find their way through ordinary glass.

That ultra-violet rays, especially of very small wave length, set up irritation of the skin is sufficiently known from accidental observation and special experiments. Those rays cause injury and seem also to cure diseases under certain conditions; at any rate, they are active. Rays of greater wave lengths are less directly injurious, but some physicians like Dr. Schanz ascribe to them the so-called ophthalmia electrica, which resembles snow-blindness. Both the crystal lens and the retina of the eye are said to be affected by ultra-violet rays. Some of our protective spectacles are little good. The blue spectacles, still to be met with, are directly absurd; the grey and black smoke glasses weaken all rays, and might answer if they were quantitatively adjustable. It is better, of course, to keep the injurious rays out altogether, and that is done to a certain extent by globes of dim, frosted and opal glass, naturally at the sacrifice of some of the light intensity. According to Schanz and Stockhausen, these glasses do not absorb all the ultra-violet rays by any means. They made experiments with different lamps, comprising the new osram, tantalum and colloid lamps, and with different glasses, and they found a remedy in their own euphos glass, which, according to the spectra they have published, effectually absorbs all ultra-violet rays. The composition of this euphos glass is not explained. It is described as a glass looking greenish yellow in transmitted light. This color is stated to be unessential, however; at any rate, other glasses merely of that color have not the same property. The euphos is made in several grades to suit different lamps, and is supposed to absorb from 3 to 5 per cent. of the light intensity. As a physiological test, Dr. Schanz mentioned that the ultra-violet rays produce fluorescence of the crystal lens. If a euphos screen is interposed between an electric lamp and the eye of a rabbit, the fluorescence at once stops, and the animal distinctly shows pain when the screen is removed again.

This paper, as we mentioned already, was eagerly discussed, and further experiments on the proportions of ultra-violet rays in our artificial lights were asked for. Dr. Voege, of the Physical Government Laboratory of Hamburg, at once took the matter up, and he describes his experiments in the *Elektrotechnische Zeitschrift*, of August 13, in which the paper by Schanz and Stockhausen is also published. His chief result is that the sunlight is far richer in ultra-violet rays than most of our modern artificial lights—with a few exceptions to be specified—and that the ultra-violet scare is therefore exaggerated. That may be so. But his experiments are all photographic, and our eye certainly does not see all that the sensitized plate shows. In his experiments Dr. Voege makes use of a kind of photometric arrangement. Two dim glass plates are so placed that they appear equally bright to the observer. The one plate is illuminated by the diffused light of the sky, the other by the lamp under test. When the photometric adjustment has been effected, photographs are taken, always under exactly the same conditions, with Schleussner plates. As the field consists of two halves, we should get two dark spots of unequal intensity, if there is any difference in the proportion of actinic rays. But the field is further subdivided by placing a screen of window glass over the one upper half, and a screen of quartz glass over the other; thus we obtain four sectors. The rays can also be filtered, before falling on the sensitized plate, through a solution of nitroso-dimethylanilin; this solution, it is to be noticed, is yellow-green in color, and it absorbs only the actinic rays of the visible spectrum, allowing the ultra-violet rays to pass.

The experiments concern the diffused light of the sky, a quartz mercury lamp, Nernst lamps with and without shades, arc lamps, regina (inclosed) arcs without outer globe, incandescence gas lamps and others. In almost all cases more ultra-violet rays were found in the artificial light than in the diffused sunlight. The exceptions are the mercury arc in a quartz tube and the regina arc lamp; but even in their cases the differences were not great. Dr. Voege further took direct photographs of the spectra of various lamps and of the sunlight through the slit of a spectrograph. In this case the sunlight gave a much longer ultra-violet spectrum than any lamp, and the interpositon of a screen of window glass did not much alter the result. Even the sunlight reflected from the slabs of sandstone stairway was richer in ultra-violet light than the electric light.

Dr. Voege hence concludes that, provided we arrange our lamps in such a way that we do not directly see the glaring filament and the arc, our eye receives less ultra-violet light from the lamps than it receives with the sunlight of equal intensity. As regards the first point—that we should avoid looking at the glowing filaments and arcs—we all agree. Dr. Voege is also right when he points out that the contrast of a bright arc on a dark background strikes us more than the light of the sun on a more or less luminous sky. But we do not admit that his actinic tests tell us much about the danger with which ultra-violet rays threaten our eyes. We have no proof so far as to which rays are really injurious to our eye. It may be those which photograph best; but this is not certain or even strongly probable.

Our eye does not resemble a sensitized plate. We have to rely upon our own experience, unless we are ready to submit ourselves to dangerous experiments such as Dr. Burch and others have undertaken for the direct study of fatigue of the eye. Individuality no doubt plays an important part. Some of us are exceedingly sensitive to the rays from an ordinary arc or a mercury arc; others can bear a good deal. But none of us like to look at a glowing filament, while we do not mind the soft light of a dim glass bulb. Dr. Voege may be quite right about sunlight. Not many of us can read in bright sunlight

with impunity. We have to avoid glaring light, and to provide our lamps with suitable shades, even if we lose some light. As long as we do not understand the problem, general care is most advisable. Too much light may be nearly—if not quite—as bad as too little.

Attitude of the Law Toward Electricity.

By Mr. Emerson W. Read, San Francisco.

Electrical companies are each year more impressed with the necessity of guarding against damage from lightning. However, not only is there need for protection to apparatus, buildings, and wiring; the law has laid down certain rules requiring companies which stretch wires and erect various appliances peculiarly adapted and situated to attract lightning, to protect those who are endangered by such wires and appliances during lightning storms.

While electrical companies have no special control over atmospheric electricity, yet it is because of their apparatus that damage is often done. Some courts have viewed lightning damage through electric wires as a direct consequence of "act of God." An Arizona court has decided that an electric company, in extending its wires into a building for proper purposes, is under no obligation to insulate such wires to give protection to the building and its occupants from lightning stroke. The court explained that lightning was electricity having its origin in the clouds or atmosphere. (Light, etc., Co. vs. Bennett, 74 Pa., 48.) Generally the rule is not so lenient as this. In a district where lightning storms are notoriously common and destructive, companies are held to the obligation of protecting their patrons and the public from injury by lightning discharges on their apparatus as far as reasonable and diligent care may protect. If there are reasonable grounds to apprehend that atmospheric electricity may be conducted over telephone wires and other apparatus to and into a house wherein a company has placed certain apparatus known to attract lightning, and there do injury, and appliances and devices exist which are well known to the company as competent to prevent such consequences, it is the legal duty of such company to acquire and use such devices in an effort to guard against accidents resulting from lightning. (Griffith vs. New England Tel., etc., Co., 72 Vt., 441.)

To have allowed wires no longer needed to remain attached to a house as a consequence of which damage by lightning resulted, is negligence on the company's part. Where a telephone company, after having removed their telephone apparatus from a store, instead of also removing the wires connecting with the house, merely cut them from the instrument, leaving the ends hanging twisted together, whereon lightning struck them and was conducted into the building and was discharged therein to the injury of the occupants, the company is liable for the resulting damage. The court held that this liability of the company extended to the customers of the store as well as the tenant. (Bell Southern Tel., etc., Co. vs. McTyler, 34 Sout. 1,020.) To illustrate the extent of judicial investigations in such matters quotations from that decision will show much: "Atmospheric electricity, or lightning, is frequently discharged from clouds and passes to the earth; that metal wires strung in the air are good conductors of electricity, much better than the air; that animal bodies, the bodies of human beings among the rest, are also better conductors than air or wood; that electricity so discharged in the vicinity of such wires is liable and apt to pass into them and along them to their ends, and thence through the best conductors at hand into the earth; that if a human body is in contact with the end of the wire, the current will pass through it to the ground, and that, though not in actual contact with the end of the wire whence the current must go to the ground, but near to it, the current, instead of passing through the air to the ground, will seek the better conductor of the body, pass through the air to it, and through it to the earth. Of course, the higher the wires extend, the nearer to the point of discharge in the air, the greater the likelihood that the current will pass into them, and the greater the extent of the wires horizontally, the more danger there is of receiving and carrying the electric current.

"It may also be said to be common knowledge that where two wires are strung near to each other, within a foot or two, on poles through the air, after the manner of telephone and telegraph wires, there is a likelihood or liability that lightning, in its descent from the clouds, will strike and follow both of them to their ends, unless diverted by other more attractive conductors, and must necessarily then pass from them to the earth through the best conductor then in its general pathway." At a further point in the decision the same judge (McClellan, C. J.) says: "If by the exercise of such reasonable precautions as a man of ordinary care and prudence would exercise in respect to such a dangerous agent, injuries to persons and property from the conduction along the wires and into the houses of atmospheric electricity may be avoided, it is the duty of companies engaged in this business to employ devices and appliances to that end. If the danger cannot be wholly avoided, due care should be taken to minimize it; and if such care is taken and there still inheres in the operation of the system a modicum of unavoidable peril to persons and property, its consequences are to be risked and submitted to in consideration of the conservation of public convenience to which they are necessarily incident." "The only justification for their (wires) being carried into a building and maintained there is the telephone service thus supplied by means of them. If they are put there not for that purpose, but for the mere convenience of the telephone company, and allowed to be in such condition as that persons and property in the building are liable to be injured by lightning gathered and brought into the building by them and there discharged, their mere presence is a wrong."

A very similar ruling occurs in Southwestern Tel., etc., Co. vs. Robinson (50 Fed. 810), showing negligence on the part of one of these companies by neglecting to dispose of wires no longer in their proper position. The wire had fallen from its usual position to a position across a public road, suspended only a few feet from the ground. In this position it had hung for several weeks when a lightning storm arose and a traveler, coming in contact with the displaced wire, was injured by a discharge of electricity attracted from the atmosphere. Here again was a case where a company, handling a contrivance notoriously known to be dangerous in such storms, had neglected to exercise its due measure of care.

Items of Interest
FROM VARIOUS LOCALITIES.

We are informed that Mr. John I. Beggs, President of the Laclede Gas Light Company, of St. Louis, Mo., in order that the members of the apprentice class of that Company may have an incentive to remain good during their 4 years of apprenticeship service, are to have given unto them a new Bible; that is, if during the interim of 4 years Mr. Beggs happens to continue as the Company's President. The covenanting agreement contains these lines: "The said apprentice covenants and agrees to honestly and industriously serve and readily obey * * * the said Laclede Gas Light Company, and to faithfully keep the secrets of the said Company; and the said Laclede Gas Light Company hereby covenants and agrees to pay the said apprentice in full compensation for his services as follows * * *, and at the expiration of the said period of apprenticeship to present the apprentice with a new copy of the Bible." Now, boys; there is an incentive to you.

Mr. Horace H. Miller, Secretary of the Pacific Lighting Corporation, informs us that hereafter the offices of the Corporation will be located on the fourth floor of the Thomas Clunie Building, 519 California street, San Francisco. The headquarters were formerly 502 California street.

The new storage holder, recently constructed by the Cruse-Kemper Company, of Philadelphia, for the Burlington (Vt.) Light and Power Company, has worked from start without a hitch. It is up to retaining 400,000 cubic feet.

Mr. George Blu has resigned the position of Traffic Manager of the Cincinnati Gas, Coke and Coal Mining Company, in order to ally himself with the selling staff of the J. D. Barth Coal Company.

"R. V. M.," of Washington, D. C., informs us that contracts for the construction of the buildings of the proposed Havre de Grace (Md.) Gas Company have been awarded to Mr. John L. Sweigard, of Philadelphia, and that it is quite certain the plant will be in readiness for operation by January 1st. The officers of the Havre de Grace Company are: Directors, R. H. Smith, W. W. Hess and Francis I. Jones, of Philadelphia; and John A. Russell and John W. Foster, of Havre de Grace; President, R. H. Smith.

The papers incorporating the General Coke and Gas Company, of Jersey City, N. J., have been filed by Messrs. R. R. Thien, E. O. Coghlan and E. S. Mantz. The concern is capitalized in $290,000, and its purpose is "to manufacture coke and gas fuel, heating, etc."

THE Public Service Commission of the Second New York District has granted the application of the Madison County (N. Y.) Gas and Electric Company for consent to issue $45,000 in gold bonds under a first consolidated mortgage. The order is made conditional that the bonds be sold at not less than 80, and that the capital secured from the sale of bonds be devoted to and used for the construction of a 60,000-volt transmission line from the steam plant of the Madison County Gas and Electric Company in Oneida to Oneida Castle, and for the purchase of the necessary right of way therefor, and the installation in Oneida of a proper generator and the necessary instruments and appliances for putting in proper repair an overhead system of the Madison County Gas and Electric Company in Oneida, and in changing a part of the system from 60 to 40 cycles."

THE Jacksonville (Fla.) Gas Company is constructing a large addition to the capacity of its purifying plant. The contracts for same, we are told, have all been awarded, but we do not know to whom.

THE Laclede Gas Light Company has declared the usual quarterly dividends on its shares, payable the 10th inst.

THE Gas Bench Construction Company, of St. Louis, has recently been awarded the contract by the Railways' Equipment Company, of New York city, for refilling the benches in the Terre Haute (Ind.) plant. The Gas Bench folks further seem to have quite something too, for they now have on their books orders for benchwork at the following places: Peru, Valparaiso, La Porte and Franklin, Ind.; Centralia, Ills.; Bangor, Me.; Boonville, Mo.; Ishpeming, Mich.; and Aberdeen, Wash.

A SPECULATOR named A. Genslein, of Los Angeles, Cal., has been actively canvassing for the signatures of residents of Oceanside, Cal., signifying their willingness to become customers of a Gas Company for that place which is being proposed by Genslein and his associates.

THE City Electrician, of Dallas, Tex., Mr. C. W. Graham, is engaged in inspecting all of the electric supply meters that are on the lines of the local Gas Company.

ON August 30th a writ of mandamus was asked for in the Pittsburgh (Pa.) Court of Common Pleas against the Philadelphia Natural Gas Company. The applicant was Mrs. Bessie Zeempfb, who asked that the Company be obliged to show cause why it had disconnected the gas service from the street mains to the service pipes of a house on 15th street, Sharpsburg, in which complainant was one-half owner. She avers that, although the property is worth $15,000, the Company demanded a deposit of $35. The demand had been refused and the gas had been cut off from the house on August 14th at midnight. During the hearing it was brought out that complainant's father, Charles Zeempfb, had had a dispute with the Company over a gas bill for gas supplied to the Phœnix Varnish Company, of which he is proprietor. A suit in the latter case is pending. The court took the papers and reserved its decision. To say the least, it looks queer that the Company should proceed so against the daughter or any other relative, especially if the daughter or other relative "pays as she goes."

"S. M. G.," writing under date of the 25th ult., incloses the following from Riverside, Cal. "The movement for a merger for all the independent gas companies in the Valley, including the plants in Riverside, Redlands and Colton, also a prospective system in Riverside, has been received. Overtures have been made in the last few days to the San Bernardino Company, but as yet nothing tangible has developed up-to-date. The proposed plan is to build a large, central, high pressure line system, with Colton as the central point, and supply therefrom all surrounding settlements, a number of which are, of course, not now supplied. The expenditure is put at $500,000, and it certainly will easily absorb that sum."

THE Washington (D. C.) *Herald* of recent date said that, contrary to expectation and to published reports, it is practically assured that the local gas companies will not be assessed in the coming tax assessment of the city for the 40,000 gas meters which they own and operate throughout the District. Assessor W. P. Richards, when asked about the matter, said that undoubtedly meters are categoried and regarded as private property, and therefore are exempt from taxation, because the law declares that corporations pay a tax of 5 per cent. on their gross earnings, in lieu of personal taxes. In their books of the triennial assessment, recently submitted to the Commissioners by the Assessors, the meters were omitted until an opinion could be obtained from the Corporation Counsel as to whether they could be regarded or held as other than personal property. The opinion (it was returned a day ago) declared that the meters were unquestionably personal property, and hence exempt."

MRS. ESTELLE MCMILLIN STEWART (formerly Miss Estelle McMillin) has remarried. Her present husband is Signor Ubaldo Traverso, a well-known lawyer of Florence, Italy.

THE authorities of Bucyrus, O., are still persisting in engaging the taxpayers in the operation of a municipal lighting plant.

LAST week we made some mention of the "Jingle Contest," so successfully carried out by the Suburban Gas Company, of Philadelphia. The first prize was awarded to Mr. T. Harry Thompson, of Chester—the prize was a double oven Acorn gas range—and here is a reproduction of "Harry's" ode:

"What is home without a mother?"
You've seen plastered everywhere.
"What is home without a gas range?"
Isn't printed—still it's there,

Or should be. "Mother" will admit it,
For it's "Mother" ought to know.
An hour saved for sleep in the morning
Certainly helps some; doesn't it though?

No wood to chop, or coal to carry;
No red faces any more.
"Cook with gas" should be your motto,
Call up "Chester, Two-O-Four!"

IT'S a pity that the paternity of the above cannot be clearly traced to "Fred." Shelton. His pegasus has been known to have made strange flights!

THE Wisconsin Engine Company informs us that it is in the field to take up the matter of furnishing figures on the cost of gas engines in units up to 5,000-horse power.

THE Public Service Commission, Second New York District, has selected the 21st inst. as the date for hearing testimony in the matter of the application of the authorities of Hudson, N. Y., for an order reducing the gas selling rate in that city. The hearing will be held in the Capitol, Albany.

THE exact standing of this particular case will be understood when these facts are considered. The residents of East Pueblo, Cal., want gas, and the proprietors of the Pueblo Gas and Fuel Company, whose piping system could be easily extended to the first named place, some time ago applied to the authorities for the necessary franchise, agreeing to supply gas in East Pueblo within a certain time and at a certain rate. The application remained unacted upon for a seemingly abnormal time, but the reason for the delay, or at least *a* reason for it, now comes up in the application to do the work by a new Company (the East Pueblo), prominent in the scheme of which appears the name of an Alderman of Pueblo, Mr. J. C. Craft. There, we have it!

"R. T. J.," writing from Keene, N. H., under date of August 28th, says: "At a special meeting of the Mayor and Board of Aldermen of this city, a license was granted the Keene Gas and Electric Company to trim trees which interfere with its lighting circuit, which are entirely within the limits where the street lighting circuits ran. The work is to be done under the direction of Civil Engineer Wadsworth, who is also to be the arbiter as to the necessity of pruning any tree.

SUPERINTENDENT EMERSON, of the Street Department, Boston, Mass., has signed the contract for the lighting of the streets in so far as that is done by means of gas and naphtha lamps, the contract remaining as it was originally agreed upon. The main features of it were given in the JOURNAL some time ago. The agreement was held up for some time through the efforts of the labor leaders of the city to have inserted in the contract a clause compelling the Rising Sun Street Lighting Company (the contractor) to engage itself not to pay less than $2.25 per day to its lamplighters.

MESSRS. JOHN HELLEN, H. A. Thornton and John A. Hulswit have filed articles incorporating the Big Rapids (Mich.) Gas Light Company. It is capitalized in $50,000.

THE Cairo City (Ills.) Gas Company has been acquired by the McKinley syndicate. This further means that the named syndicate is in full control of the artificial lighting system of Cairo City, and of its traction interests as well.

The Market for Gas Securities.

It is a long hark back to find a like quotation for Consolidated to that which came in at noon to-day (Friday) 147⅞–148. Not that it is any too high intrinsically, but that it is somewhat nearer its worth. The stock remained strong all week, despite the oddities of the market, which were well disposed to the low side. If the speculative contingent is wise, it will not sell any Consolidated. We presume many of our readers smiled softly when we predicted 150 for Consolidated before October 1st. Well, we hope some of them followed the information.

Brooklyn Union is 133 to 136; Peoples, of Chicago—watch this gas gem, too—is 96 to 96½, ex., and Massachusetts gas is seemingly on the way to 60. The Laclede Gas Company, of St. Louis, will pay 1¼ per cent. on the common, the 15th inst.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

SEPTEMBER 7.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share:

N. Y. City Companies.	*Capital.*	*Par.*	*Bid*	*Asked.*
Consolidated Gas Co.	$78,177,000	100	146⅞	147
Central Union Gas Co.—				
1st 5's, due 1928, J. & J.	3,000,000	1,000	93	93¼
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S.	1,000,000	1,000	—	105
Mutual Gas Co.	3,500,000	100	130	160
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	92	96
New York & Richmond Gas				
Co. (Staten Island)	1,500,000	100	37	43
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	—	98	104
New York and East River—				
1st 5's, due 1944, J. & J.	3,500,000	1,000	100	105
Con. 5's, due 1945, J. & J.	1,500,000	—	97	101
Northern Union—				
1st 5's, due 1947, J. & J.	1,250,000	1,000	90	98
Standard	5,000,000	100	70	100
Preferred	5,000,000	100	100	125
1st Mtg. 5's, due 1930, M. & N.	1,500,000	1,000	100	105
The Brooklyn Union	15,000,000	1,000	133	136
1st Con. 5's, due 1948, M. & N.	15,000,000	—	91½	92
Yonkers	299,600	500	120	—
Out-of-Town Companies.				
Bay State	50,000,000	50	2⅝	2¾
" Income Bonds	2,000,000	1,000	—	75
Binghampton Gas Works	450,000	100	—	65
" 1st Mtg. 5's	500,000	1,000	95	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	5	6
" " Bonds, 5's	5,250,000	1,000	63	66
Capital, Sacramento	500,000	50	—	35
Bonds (6's)	150,000	1,000	—	—
Chicago Gas Co. Guaranteed				
Gold Bonds	7,660,000	1,000	104	104¼
Cincinnati Gas and Electric				
Co.	20,500,000	100	90½	91
Columbus (O.) Gas Co., 1st				
Mortgage Bonds	1,500,000	1,000	92	96
Columbus (O.) Gas Lt. &				
Heating Co.	1,682,750	100	90½	91
Preferred	3,026,500	100	71	80
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	—	105
Mortgages, 6's	3,600,000	—	—	118
Chesapeake, 1st 6's	1,000,000	—	—	—
Equitable, 1st 6's	910,000	—	—	—
Consolidated, 1st 5's	1,490,000	—	—	112
Consolidated Gas Co. of N. J.	1,000,000	100	15	17
Con. Mtg. 5's	880,000	1,000	92	95
Bonds	75,000	—	—	100
Denver Gas and Electric	—	—	74½	75
Detroit City Gas Co	6,000,000	50	—	50
Prior Lien 5's	4,618,000	1,000	—	98
Detroit Gas Co., 5's	881,000	1,000	75	80
" nc. 5's	16,000	100	96¾	100
Equitable Gas & Fuel Co.,				
Chicago, Bonds	2,000,000	1,000	—	101
Essex and Hudson Gas Co.	6,500,000	—	30	40
Fort Wayne	2,000,000	—	—	—
" Bonds	2,000,000	—	55	—
Grand Rapids Gas Light Co.,				
1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of				
New Jersey	10,500,000	—	100	105
" Bonds, 5's	10,500,000	—	101	103½
Indianapolis	2,000,000	—	60	70
" Bonds, 5's	2,650,000	—	104½	105
Jackson Gas Co.	250,000	50	82	—
" 1st Mtg. 5's	200,000	1,000	97	100
Kansas City Gas Light Co.,				
of Missouri	5,000,000	100	—	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede Gas Co., St. Louis.	10,000,000	100	—	100
Preferred	2,500,000	100	60	90
Bonds	10,000,000	1,000	104	104¼
Lafayette Gas Co., Ind.	1,000,000	100	—	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	143	145
Madison Gas and Electric Co.				
" 1st Mtg. 6's	350,000	1,000	106	108½
" 6 per cent. scrip,				
due 1910	100,000	25	60	60½
Massachusetts Gas Companies, of Boston	25,000,000	100	55	56
Preferred	25,000,000	100	87¾	88
Montreal Gas Co., Canada	2,000,000	100	218	218½
Nashville Gas Light Co.	1,000,000	100	110	—
Newark, N. J., Con. Gas Co.	6,000,000	—	56	58
Bonds, 6's	6,000,000	—	137	138
New Haven Gas Co.	2,000,000	25	200	—
Peoples Gas Lt. & Coke Co., Chicago	25,000,000	100	96	96¾
1st Mortgage	20,100,000	1,000	—	—
2d "	2,500,000	1,000	104	—
Rochester Gas & Electric Co.	2,150,000	50	88	—
Preferred	2,150,000	50	118	—
Consolidated 5's	2,000,000	—	104½	105½
San Francisco Gas Co., Cal.	15,500,000	—	—	—
St. Joseph Gas Co.—				
1st Mtg. 5's	751,000	1,000	92	—
St. Paul Gas Light Co.	1,500,000	100	45	47
1st Mortgages, 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's	2,465,000	1,000	96¼	—
Syracuse Gas Co., N. Y	1,975,000	100	50	55
Bonds	2,047,000	1,000	102	—
Washington (D. C.) Gas Co.	2,600,000	20	328½	335
1st Mortgage, 6's	600,000	—	—	—

Advertisers' Index.

GAS ENGINEERS.

Bartlett, Hayward & Co., Baltimore, Md. 433
Cruse-Kemper Co., Philadelphia, Pa. 420
Davis & Farnum Mfg. Co., Waltham, Mass. 432
Economical Gas Apparatus Construc. Co., Toronto, Ont. 431
Frank D. Moses, Trenton, N. J. 434
Frederic Egner, Norfolk, Va. 436
Frederick J. Mayer, New York City. 417
H. M. Byllesby & Co., Chicago, Ills. 432
Humphreys & Glasgow, New York City. 432
Improved Equipment Company, New York City. 418
Isbell-Porter Co., Newark, N. J. 420
Kerr Murray Mfg. Co., Fort Wayne, Ind. 433
The Gas Machinery Co., Cleveland, O. 416
The Jeffrey Manufacturing Co., Columbus, O. 430
United Gas Improvement Co., Philadelphia, Pa. 427
Western Gas Construction Co., Fort Wayne, Ind. 396

GAS WORKS APPARATUS AND CONSTRUCTION.

Bartlett, Hayward & Co., Baltimore, Md. 433
Connelly Iron Sponge & Governor Co., New York City. 429
Continental Iron Works, Brooklyn, N. Y. 434
Cruse-Kemper Co., Philadelphia, Pa. 420
Davis & Farnum Mfg. Co., Waltham, Mass. 432
Deily & Fowler Mfg. Co., Philadelphia, Pa. 436
Economical Gas Apparatus Construc. Co., Toronto, Ont. 431
Frank D. Moses, Trenton, N. J. 434
Humphreys & Glasgow, New York City. 432
Improved Equipment Company, New York City. 418
Isbell-Porter Co., New York City. 420
Kerr Murray Mfg. Co., Fort Wayne, Ind. 433
Lloyd Construction Co., Detroit, Mich. 422
Logan Iron Works, Brooklyn, N. Y. 436
Quintard Iron Works, New York City. 421
R. D. Wood & Co., Philadelphia, Pa. 434
Riter-Conley Mfg. Co., Pittsburgh, Pa. 419
Stacey Mfg. Co., Cincinnati, O. 435
The Gas Machinery Co., Cleveland, O. 416
The Jeffrey Mauufacturing Co., Columbus, O. 430
United Gas Improvement Co., Philadelphia, Pa. 427
Western Gas Construction Co., Fort Wayne, Ind. 396

PROCESSES.

Bartlett, Hayward & Co., Baltimore, Md. 433
Economical Gas Apparatus Construc. Co., Toronto, Ont. 431
Humphreys & Glasgow, New York City. 432
Improved Equipment Company, New York City. 418
Semet-Solvay Co., Syracuse, N. Y. 430
The Gas Machinery Co., Cleveland, O. 416
United Gas Improvement Co., Philadelphia, Pa. 427
Western Gas Construction Co., Fort Wayne, Ind. 396

SCRUBBERS AND CONDENSERS.

Bartlett, Hayward & Co., Baltimore, Md. 433
Continental Iron Works, Brooklyn, N. Y. 434
Cruse-Kemper Co., Philadelphia, Pa. 420
Davis & Farnum Mfg. Co., Waltham, Mass. 432
Economical Gas Apparatus Construc. Co. Toronto, Ont. 431
Isbell-Porter Co., Newark, N. J. 420
Kerr Murray Mfg. Co., Fort Wayne, Ind. 433
Logan Iron Works, Brooklyn, N. Y. 436
R. D. Wood & Co., Philadelphia, Pa. 434
Riter-Conley Mfg. Co., Pittsburgh, Pa. 419
Stacey Mfg. Co., Cincinnati, O. 435
The Gas Machinery Co., Cleveland, O. 416
Western Gas Construction Co., Fort Wayne, Ind. 396

PRODUCER POWER PLANTS.

Economical Gas Apparatus Construc. Co., Toronto, Ont. 431
R. D. Wood & Co., Philadelphia, Pa. 434

TAR AND CARBONIC ACID EXTRACTOR.

Bartlett, Hayward & Co., Baltimore, Md. 433
Economical Gas Apparatus Construc. Co., Toronto, Ont. 431
Isbell-Porter Co., Newark, N. J. 420
Kerr Murray Mfg. Co., Fort Wayne, Ind. 433
Stacey Mfg. Co., Cincinnati, O. 435
The Gas Machinery Co., Cleveland, O. 416
Western Gas Construction Co., Fort Wayne, Ind. 396

AMMONIA CONCENTRATORS.

Bartlett, Hayward & Co., Baltimore, Md. 433
Michigan Ammonia Works, Detroit, Mich. 413
The Gas Machinery Co., Cleveland, O. 416
Western Gas Construction Co., Fort Wayne, Ind. 396

GAS METERS.

American Meter Co., New York and Philadelphia. 439
D. McDonald & Co., Albany, N. Y. 437
Helme & McIlhenny, Philadelphia, Pa. 439
John J. Griffin & Co., Philadelphia, Pa. 440
Keystone Meter Co., Royersford, Pa. 438
Maryland Meter and Mfg. Co., Baltimore, Md. 438
Metric Metal Co., Erie, Pa. 439
Nathaniel Tufts Meter Co., Boston, Mass. 438
New York Improved Meter Co., New York City. 434
Pittsburg Meter Co., East Pittsburg, Pa. 437
Rotary Meter Co., New York City. 415
Sprague Meter Co., Bridgeport, Conn. 414
United States Meter Co, Brooklyn, N. Y. 439

PREPAYMENT METERS.

American Meter Co., New York and Philadelphia. 439
D. McDonald & Co., Albany, N. Y. 437
Helme & McIlhenny, Philadelphia, Pa. 439
John J. Griffin & Co., Philadelphia, Pa. 440
Keystone Meter Co., Royersford, Pa. 438
Nathaniel Tufts Meter Co., Boston, Mass. 438
New York Improved Meter Co., New York City. 437
Pittsburg Meter Co., East Pittsburg, Pa. 437
Sprague Meter Co., Bridgeport, Conn. 414

PREPAYMENT METER ATTACHMENTS.

New York Improved Meter Co., New York City. 439

WATER METERS.

Pittsburg Meter Co., East Pittsburg, Pa. 437

GAS AND WATER PIPES.

Davis & Farnum Mfg. Co., Waltham, Mass. 432
Donaldson Iron Co., Emaus, Pa. 434
Economical Gas Apparatus Construc. Co., Toronto, Ont. 431
R. D. Wood & Co., Philadelphia, Pa. 434

GAS COALS.

Berwind-White Coal Mining Co., New York and Phila. 430
Perkins Co., New York City. 430
Westmoreland Gas Coal Co., Philadelphia, Pa. 431

GAS MAIN STOPPERS.

Edward A. Behringer, New York City. 434
Safety Gas Main Stopper Co., New York City. 429

MAIN AND SERVICE LAYING.

Sullivan Bros., Flushing, N. Y. 431

GAS TAPPING MACHINES.

George Light, Dayton, O. 431
H. Mueller Manufacturing Co. Decatur, Ills. 422

CANNEL COALS.

Perkins & Co., New York City. 430

STOKING MACHINERY.

G. A. Bronder, New York, City. 429

CONVEYORS—ALL KINDS.

Bartlett, Hayward & Co., Baltimore, Md. 433
Brown Hoisting Machinery Co., Cleveland, O. 422
Cruse-Kemper Co., Philadelphia, Pa. 420
C. W. Hunt Company, New York City. 432
Economical Gas Apparatus Construc. Co., Toronto, Ont. 431
G. A. Bronder, New York City. 429
Kerr Murray Mfg. Co., Fort Wayne, Ind. 433
The Gas Machinery Co., Cleveland, O. 416
The Jeffrey Manufacturing Co., Columbus, O. 430
Western Gas Construction Co., Fort Wayne, Ind. 396

CHARGING BARROWS & COAL WAGONS.
Davis & Farnum Mfg. Co., Waltham, Mass..... 432
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 433
Stacey Mfg. Co., Cincinnati, O..... 435

GAS ENRICHERS.
Standard Oil Co., New York City..... 387

COKE CRUSHERS.
Bartlett, Hayward & Co., Baltimore, Md..... 433
C. M. Keller, Columbus, Ind..... 431
The Jeffrey Manufacturing Co., Columbus, O..... 430

GAS METER CONNECTIONS.
H. Mueller Manufacturing Co., Decatur, Ills..... 422

GAS COCKS.
H. Mueller Manufacturing Co., Decatur, Ills..... 422

GAS GAUGES.
The Bristol Co., Waterbury, Conn..... 424

GAS GOVERNORS.
Chaplin-Fulton Mfg. Co., Pittsburg, Pa..... 435
Connelly Iron Sponge & Governor Co.,New York City. 429
Isbell-Porter Co., Newark, N. J..... 420
Pittsburg Meter Co., East Pittsburg, Pa..... 434
R. D. Wood & Co., Philadelphia, Pa..... 434
Reynolds Gas Regulator Co., Anderson, Ind..... 429

CEMENTS.
C. L. Gerould, Pittsburgh, Pa..... 434

RETORTS AND FIREBRICKS.
Baltimore Retort and Firebrick Co., Baltimore, Md... 428
Didier-March Co , New York City 417
Gas Bench Construction Co., St. Louis, Mo..... 428
Henry Maurer & Son, New York City..... 421
Improved Equipment Company, New York City..... 418
James Gardner, Jr., Co., Bolivar, Pa..... 430
J. H. Gautier & Co., Jersey City, N. J..... 428
Laclede-Christy Clay Products Co., St. Louis, Mo..... 420
Missouri Firebrick Co., St. Louis, Mo..... 428
Parker-Russell Mining and Mfg. Co., St. Louis, Mo.... 424

INCLINED RETORTS.
Baltimore Retort and Firebrick Co., Baltimore, Md... 428
Didier-March Co., New York City 417
Gas Bench Construction Co., St. Louis, Mo..... 428
Improved Equipment Company, New York City..... 418
Laclede-Christy Clay Products Co., St. Louis, Mo..... 420
Parker-Russell Mining and Mfg. Co., St. Louis, Mo... 424

VERTICAL S'S.
Connelly Iron Sponge & Gov.Co.(Drake's [Eng.] System) 429
Didier-March Co., New York City..... 417
Gas Bench Construction Co., St. Louis, Mo..... 428
Improved Equipment Company, New York City..... 418
Laclede-Christy Clay Products Co., St. Louis, Mo..... 420
Parker-Russell Mining and Mfg. Co., St. Louis, Mo... 424

REGENERATIVE FURNACES.
Baltimore Retort and Firebrick Co., Baltimore, Md.. 428
Bartlett, Hayward & Co., Baltimore, Md..... 433
Didier-March Co., New York City..... 417
Gas Bench Construction Co., St. Louis, Mo..... 428
Improved Equipment Company, New York City..... 418
J. H. Gautier & Co., Jersey City, N. J..... 428
Laclede-Christy Clay Products Co., St. Louis, Mo..... 420
Missouri Firebrick Co., St. Louis, Mo..... 428
Parker-Russell Mining and Mfg. Co., St. Louis, Mo... 424

SELF-SEALING MOUTHPIECE DOORS.
Bartlett, Hayward & Co., Baltimore, Md..... 433
Continental Iron Works, Brooklyn, N. Y..... 434
Davis & Farnum Mfg. Co., Waltham, Mass..... 432
Isbell-Porter Co., Newark, N. J..... 420
Improved Equipment Company, New York City..... 418
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 433
Logan Iron Works, Brooklyn, N. Y..... 436
R. D. Wood & Co., Philadelphia, Pa..... 434
Stacey Mfg. Co., Cincinnati, O..... 435
The Gas Machinery Co., Cleveland, O..... 416
Western Gas Construction Co., Fort Wayne, Ind..... 396

INCANDESCENT GAS LAMPS.
General Gas Light Co., Kalamazoo, Mich..... 423
Welsbach Company, Gloucester, N. J..... 426

BURNERS.
Wm. M. Crane Co., New York City..... 424

STREET LAMPS.
Thos. T. W. Miner, New York City..... 432
Welsbach Street Lighting Co., New York and Phila.. 426

DRILLS—ROCK AND STONE.
The Jeffrey Manufacturing Co., Columbus, O..... 430

PULVERIZERS.
The Jeffrey Manufacturing Co., Columbus, O..... 430

PURIFIERS.
Bartlett, Hayward & Co., Baltimore, Md..... 433
Connelly Iron Sponge & Governor Co., New York City. 429
Cruse-Kemper Co., Philadelphia, Pa..... 430
Davis & Farnum Mfg. Co.. Waltham, Mass..... 432
Isbell-Porter Co., Newark, N. J..... 420
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 433
R. D. Wood & Co., Philadelphia, Pa..... 434
Stacey Mfg. Co., Cincinnati, O..... 435
Western Gas Construction Co., Fort Wayne, Ind..... 396

PURIFYING MATERIALS.
Connelly Iron Sponge & Governor Co., New York City 429

VALVES.
Bartlett, Hayward & Co., Baltimore, Md..... 433
Continental Iron Works, Brookln, N. Y..... 434
Davis & Farnum Mfg. Co., Waltham, Mass..... 432
Economical Gas Apparatus Construc.Co., Toronto, Ont. 431
Isbell-Porter Co., Newark, N. J..... 420
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 433
Ludlow Valve Manufacturing Co., Troy, N. Y..... 421
R. D. Wood & Co., Philadelphia, Pa..... 434
Stacey Mfg. Co., Cincinnati, O..... 435
The Gas Machinery Co , Cleveland, O..... 416
The P. H. & F. M. Roots Co., Connersville, Ind..... 423
Western Gas Construction Co., Fort Wayne, Ind..... 396

EXHAUSTERS.
Connelly Iron Sponge & Governor Co.,New York City 429
Connersville Blower Company, Connersville, Ind..... 414
Davis & Farnum Mfg. Co., Waltham, Mass..... 432
Isbell-Porter Company, Newark, N J 420
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 433
Piqua Blower Co., Piqua, O..... 421
The P. H. & F. M. Roots Co., Connersville, Ind..... 423

PURIFIER AND SCRUBBER TRAYS.
Bartlett, Hayward & Co., Baltimore, Md..... 433
Cabot Mfg. Co., Hoboken, N. J..... 431
Western Gas Construction Co., Fort Wayne, Ind..... 396

GAS STOVES.
American Meter Co., New York and Philadelphia..... 429
Keystone Meter Co., Royersford, Pa..... 439
Maryland Meter & Manufacturing Co., Baltimore, Md... 433
Nathaniel Tufts Meter Co., Boston, Mass..... 438

HOT WATER HEATERS.
Humphrey Co., Kalamazoo, Mich..... 422

GASHOLDERS.
Bartlett, Hayward & Co., Baltimore, Md..... 433
Continental Iron Works, Brooklyn, N. Y..... 434
Cruse-Kemper Co., Philadelphia, Pa..... 430
Davis & Farnum Mfg. Co., Waltham, Mass..... 432
Deily & Fowler Mfg. Co., Philadelphia, Pa..... 436
Economical Gas Apparatus Construc. Co., Toronto, Ont. 431
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 433
Logan Iron Works, Brooklyn, N. Y..... 436
R. D. Wood & Co., Philadelphia, Pa..... 434
Riter-Conley Mfg. Co., Pittsburgh, Pa..... 419
Stacey Mfg. Co., Cincinnati, O..... 435
Western Gas Construction Co., Fort Wayne, Ind..... 396

STORAGE TANKS.
Bartlett, Hayward & Co., Baltimore, Md..... 433
Davis & Farnum Mfg. Co., Waltham, Mass..... 432
Stacey Mfg. Co., Cincinnati, O..... 435
Western Gas Construction Co., Fort Wayne, Ind..... 396

PATENTS, TRADE-MARKS, COPYRIGHTS.
Royal E. Burnham, Washington, D. C..... 429

Position Wanted
As Manager or Superintendent,

By competent gas man, 35 years of age, married, strictly sober, with operating experience both as manager and superintendent in actual charge of plants. A man who can show and give results; 17 years' experience; now acting as manager of coal gas plant in city of 15,000. Will have to give present people 60 days' notice. Address,
1727-eot-tf "RESULTS," care this Journal.

Position Wanted
Either as Superintendent or Manager.

First class man in every respect. Competent and energetic. Best of references furnished. Eleven years' experience in the manufacture (either coal or water gas), distribution and commercial departments.
1734-3 Address, "W. C.," care this Journal.

Gas Salesman.
Experienced in electrical competition. Capable of handling gas engine installations, displacing electric and gasoline motors. At present employed at good salary, but anxious to make a change where efforts will be appreciated. If you desire to increase your sales of gas for power and industrial purposes,
1735-1 Address, "C. E.," care this Journal.

WANTED,
Position as Manager, Superintendent or Engineer.

By a young married man, who has had 14 years' practical experience in the manufacture and distribution of coal and carburetted water gas; also in the designing and erection of all kinds of gas machinery. Party is a draughtsman and chemist. Can give the best of references.
1734-2 Address, "J. A. H.," care this Journal.

WANTED.
POSITION AS SOLICITOR.

Have had 10 years' experience in new business and 6 years' experience in street department, and have always shown good results. Can furnish best of references. State salary you will pay.
1735-1 Address, "S.," care this Journal.

Position Wanted.
SUPERINTENDENT,

Experienced in manufacture, distribution, betterment and management of gas plants. Competent, strictly reliable, aggressive, successful. Modern ideas in new business methods. Confidential correspondence.
1735-2 Address, "A. M. D.," care this Journal.

WANTED,
SUPERINTENDENT

Who can take charge of small coal gas plant and street department, in town of 12,000, Middle State. State age, experience, and salary expected.
1734-3 Address, "C. C. A.," care this Journal.

WANTED,
GOOD GAS SOLICITOR,

By JACKSONVILLE GAS COMPANY,
1731-2 JACKSONVILLE, FLA.

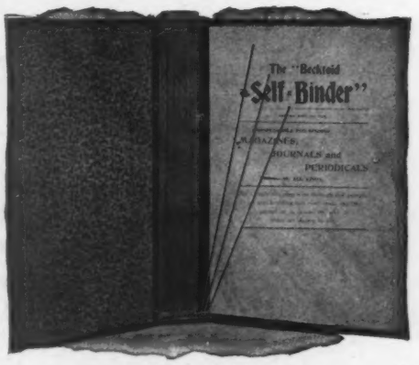
DISTRICT MANAGER WANTED

Who is competent to take charge of the operation of gas and electric properties (New England). He must have a good technical knowledge of electric light and power and coal and water gas apparatus, as to their most efficient operation and distribution of their products. Must have business capacity, executive ability and experience. A permanent and remunerative position for a competent man. Only efficient and experienced men need apply. In making application state salary required. Applications will be regarded as strictly confidential. Address, "A. M. J.,"
1735-2 Care this Journal.

J. S. DIXON,
92 La Salle St., Chicago, Ills.,
Plans and Specifications for Gas Plants.
1735-1

Utilize Your Gas Liquor.
NO EXTRA LABOR OR OPERATING EXPENSES.
IMPROVED AMMONIA CONCENTRATOR.
About 100 in use. Write to
STROH & OSIUS, Patentees, or
MICHIGAN AMMONIA WORKS, - Detroit, Mich.

BINDER for the JOURNAL.



Price, $1.00.

A. M. CALLENDER & CO., 42 Pine Street, N. Y.

The Sprague Meter Co.

Manufacturers of

Cast Iron Gas Meters

for

Artificial or Natural Gas

Plain or Prepayment

Lower in first cost and cheaper to maintain than any meter on the market.

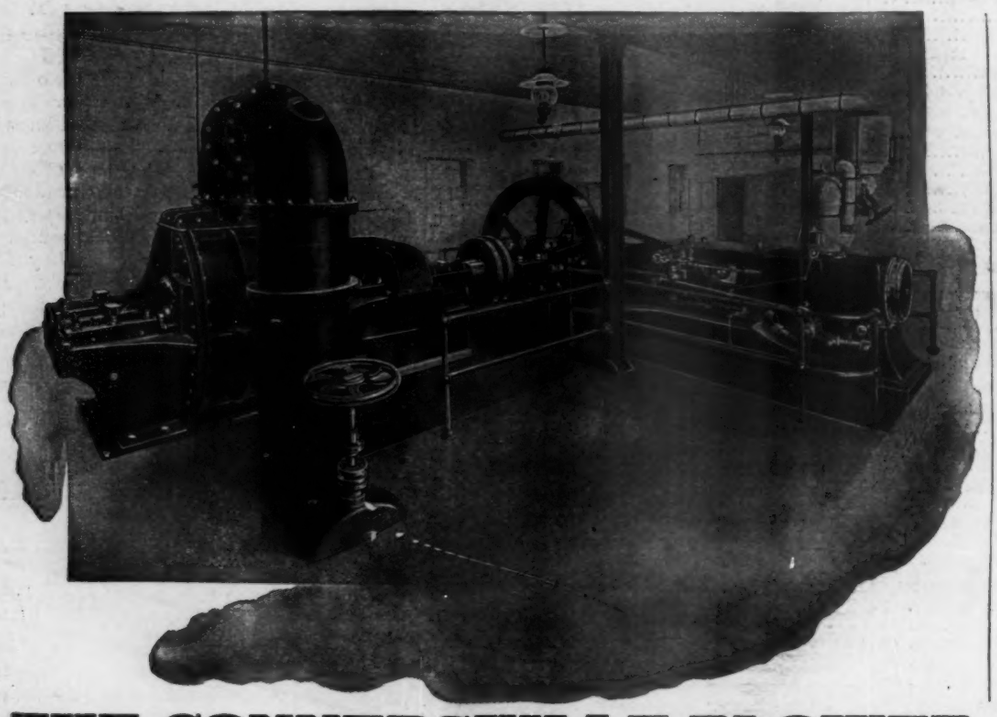
Write us for particulars.

The Sprague Meter Company

203 Water St., Bridgeport, Conn.

CONNERSVILLE GAS EXHAUSTERS

AND HIGH PRESSURE GAS PUMPS.



THIS cut shows one of our High Pressure machines and a 4-valve engine connected by one of our leather link flexible couplings. Two of these units were installed for the Peoples Gas Light and Coke Co., Chicago, at their 73d St. Station. Each machine has a capacity of 14,000,000 cubic feet per day.

—o—

We also manufacture

GAS VALVES,
BY-PASS VALVES,
PRESSURE REGULATORS,
ETC., ETC.

Correspondence Solicited.

THE CONNERSVILLE BLOWER COMPANY,
Connersville, Indiana, U. S. A.
NEW YORK OFFICE, 50 Church Street. - - HORACE G. COOKE, Selling Agent.

THE SEVENTH EDITION, ILLUSTRATED,

— OF THE —

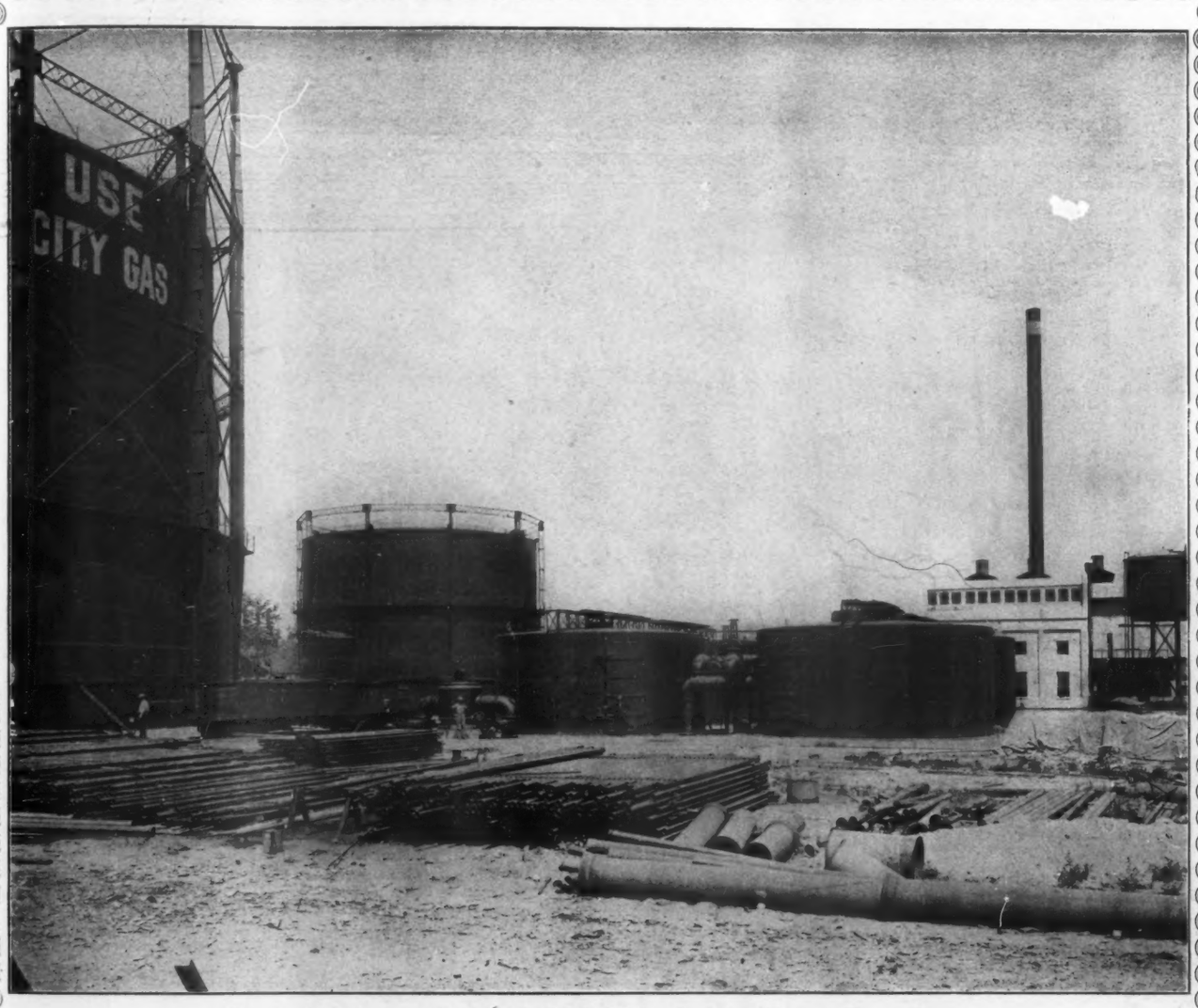
Handbook for Gas Engineers and Managers,

By THOMAS NEWBIGGING, M. INST. C.E.

This Edition of the "Handbook for Gas Engineers and Managers" is a great improvement on all previous editions. Much of the text has been re-written, in order to keep the work abreast of the constant advances that are being made in the Gas Industry.

PRICE, - $6.50.

A. M. CALLENDER & CO., 42 Pine Street, New York City.



Installation of the 5,000,000 Cubic Foot Per Day

ROTARY STATION METER

At the Works of the City Gas Company, Los Angeles, California.

We have Recently Contracted with the ILLINOIS STEEL COMPANY
(United States Steel Corporation) for the delivery of

FOUR (4) ROTARY STATION METERS,

Each Having a Capacity of **3,840,000 Cubic Feet per Day.**

These Machines will be Installed at Joliet, Illinois, to Measure Product of Coke Ovens Now Under Construction by that Company.

ROTARY METER COMPANY

One-half the cost—One-tenth the space of old style wet meters.

When in need of Station Meters, write

ROTARY METER COMPANY,

280 Broadway,
NEW YORK.

Send for Catalog.

P. PLANTINGA, President W. E. STEINWEDELL, Secretary

THE GAS MACHINERY CO.,

Main Office and Shops

CLEVELAND, OHIO.

NEW YORK OFFICE, - - 56 PINE STREET.

COAL AND WATER GAS APPARATUS.
EXHAUSTERS, CONDENSERS, SCRUBBERS,
TAR EXTRACTORS, WASHERS, PURIFIERS,
VALVES, CONNECTIONS.
BY PRODUCT MACHINERY.
COMPLETE GAS PLANTS.

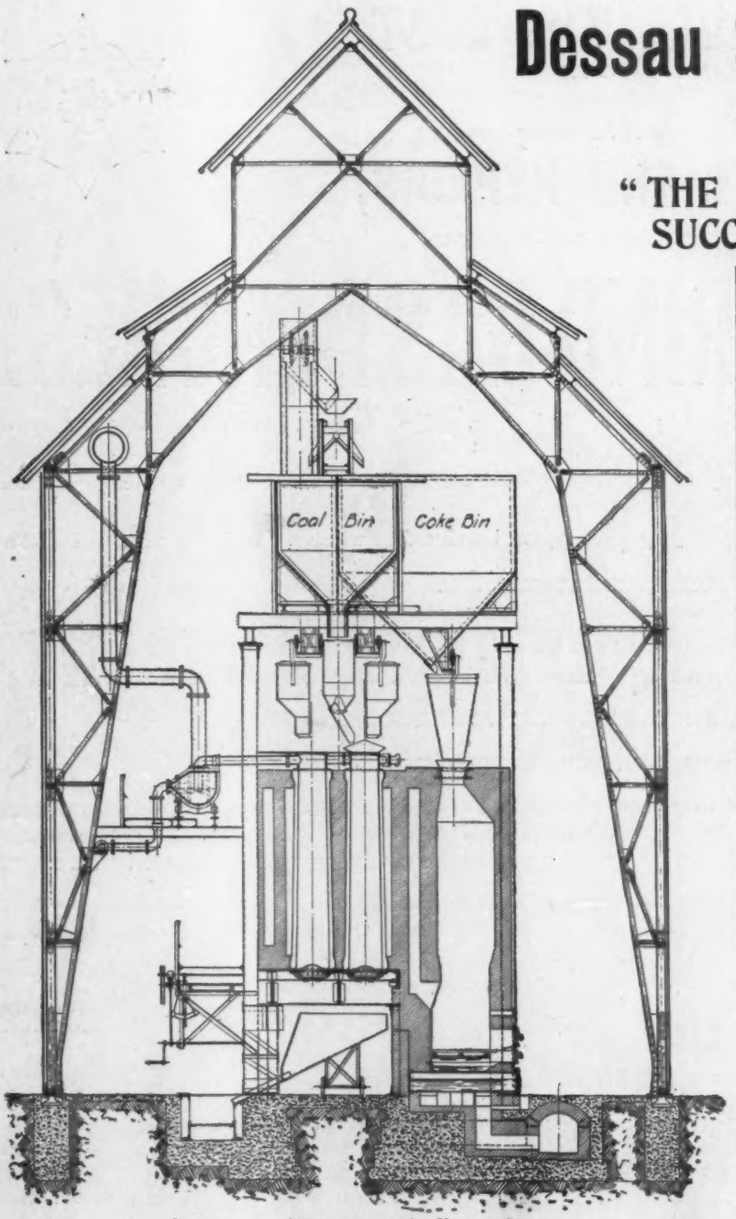
PACIFIC COAST AGENTS: Hallidie Machinery Co., Seattle, Wash.

APPARATUS
FOR MANUFACTURING
AQUA AMMONIA
AND
ANHYDROUS AMMONIA.

THE GAS MACHINERY CO.
CLEVELAND, OHIO.

Dessau System of Vertical Retorts.

"THE ONLY SYSTEM IN SUCCESSFUL OPERATION."



Cross Section of Retort House for Vertical Benches.

- Nineteen Installations with 126 Benches in operation.
- **ELEVEN** Installations with **96** Benches in course of construction.
- Maximum gas produced per man per 24 hours, 360,000 cu. ft.
- Ten per cent. increase in yield of gas.
- Forty per cent. increase in yield of ammonia.
- Best quality of coke.
- Least percentage of breeze.
- Low fuel consumption.
- Tar produced low in carbon.
- Extreme low cost of retort house labor.
- Minimum expense in wear and tear.
- No Naphthaline.
- No Cyanogen.

Present Producing Capacity, 25 Million Cu. Ft.

Within **90 days** the above producing capacity has been increased to **31 Million Cubic Feet** by additional orders for **39 benches** with **390 retorts.**

DIDIER-MARCH COMPANY,

FREDERICK J. MAYER, General Manager.

FACTORIES:
Keasbey, N. J.

Hudson Terminal Building, 50 Church St.,
New York City, N. Y.

REDUCE THE COST
OF
LABOR,
FUEL AND REPAIRS,
BY INSTALLING

NON-CLINKERING GAS BENCHES.

The claims for our Benches are broad, but easily proven to be true, and we stand ready to furnish the proof upon request.

All our clams for savings when summed up mean A SAVING IN MONEY, which we believe is all any gas man can ask.

Let us show you how we can save YOU money by placing your bench orders with us. Write for our new Bulletin No. 2.

THE IMPROVED EQUIPMENT COMPANY,

MAIN OFFICES: 60 WALL STREET, NEW YORK.

SOLE LICENSEES FOR THE DOHERTY BENCH FUEL ECONOMIZER.

SCIENTIFIC BOOKS.

CHEMISTRY OF GAS MANUFACTURE. By W. J. A. Butterfield. Vol. I., Material and Processes. $2.50. Vol. II., In Preparation.

DISTRIBUTION OF GAS. By Walter Hole, C.E. $5.

MODERN APPLIANCES IN GAS MANUFACTURE. By Fletcher W. Stevenson. $2.

MODERN GAS ENGINES AND PRODUCER GAS PLANTS. By R. E. Mathot. $2.50.

COAL TAR AND AMMONIA. By George Lunge. $15.

GAS ANALYSIS. By Dr. W. H. Birchmore. $1.25.

ELECTRIC GAS LIGHTING. By H. S. Norrie. 50 cents.

GAS ANALYST'S MANUAL. By J. Abady. $6.50.

GAS ENGINE DESIGN. By C. Edward Lucke, Ph.D. $3.

THE "GAS WORLD" YEAR BOOK, 1903. Edited by John Douglas. $3.

GAS AND GAS WORKS. By Hughes and O'Connor. $2.50

POOLE ON FUELS. By Herman Poole. $2.

GAS ENGINEER'S POCKET-BOOK. By Henry O'Connor $3.50.

GAS CONSUMER'S HANDYBOOK. By Wm. Richards. 20 cents.

PRACTICAL TREATISE ON HEAT. By Thomas Box. 2d edition. $5.

PRACTICAL PHOTOMETRY: A Guide to the Study of the Measurement of Light. By W. J. Dibdin. $3.

CHEMICAL TECHNOLOGY: Vol. I., *Fuel and Its Applications*, $5. Vol. II., *Lighting*, $4.

IRON WORK: Practical Designing of Structural Ironwork. By H. Adams. $3.50.

SELF-INSTRUCTION FOR STUDENTS IN GAS MANUFACTURE. Elementary, advanced and constructional, each, $1.50.

LIQUID FUEL FOR MECHANICAL AND INDUSTRIAL PURPOSES. By E. A. Brayley Hodgetts. $2.50.

COX'S GAS FLOW COMPUTER. High pressure $4.50.

GAS ENGINE. By F. R. Hutton, E.M., Ph.D., Sc.D. $5.

TECHNICAL GAS ANALYSIS. By Winkler & Lunge. $4.

CHEMISTRY OF GAS MANUFACTURE. By Harold M. Royle, F.C.S. $4.50.

HEMPEL'S GAS ANALYSIS $2.25

HANDBOOK FOR GAS ENGINEERS AND MANAGERS. Seventh edition. By Thomas Newbigging $6.50.

GAS, GASOLINE AND OIL ENGINES. By Gardner D. Hiscox. Fifteenth edition. $2.50.

PRACTICAL HANDBOOK ON GAS ENGINES. By G. Lieckfeld. $1.

HEAT A MODE OF MOTION. By John Tyndall. $2.50.

THEORY OF HEAT. By J. Clerk-Maxwell. $1.50.

AMMONIA AND AMMONIUM COMPOUNDS. By Dr. R. Arnold. $2.

GASFITTERS' QUESTION BOOK, WITH ANSWERS. By Albert Dunbar, S.B. $1.50.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS. By D. A. Graham. $3.

A TEXT BOOK OF INORGANIC CHEMISTRY. By Prof. Victor Von Richter. $2.

ILLUMINATING AND HEATING GAS. By W. Burns. $1.50

HANDBOOK FOR MECHANICAL ENGINEERS. By H. Adams. $2.50.

FINANCES OF GAS, ELECTRIC LIGHT AND POWER ENTERPRISES. By Wm. D. Marks. $4.

THE "GAS WORLD" ANALYSES OF ACCOUNTS OF GAS UNDERTAKINGS FOR 1906-1907. $4.

STANDARD REDUCTION FACTORS FOR GASES. By Helon Brooks MacFarland. $1.50.

PRACTICAL PLUMBING. By P. J. Davies. Vol. I., $3. Vol. II., $4.50.

AMERICAN SANITARY PLUMBING. By James J. Lawler. $2.

HENLEY'S 20TH CENTURY BOOK OF RECIPES, FORMULAS AND PROCESSES. By Gardner D. Hiscox. $3.

FIELD'S ANALYSIS, 1907. $5.

TREATISE ON MASONRY CONSTRUCTION. Baker. $5.

AMERICAN GAS ENGINEERING PRACTICE. By M. Nisbet Latta. $4.50.

A COMPARISON BETWEEN THE ENGLISH AND FRENCH METHODS OF ASCERTAINING THE ILLUMINATING POWER OF COAL GAS. $1.50.

JONES JET PHOTOMETER, for Coal or Water Gas. Each $10.

ELECTRICITY.

ELECTRIC WIRING DIAGRAMS AND SWITCHBOARDS. By Newton Harrison, E.E. $1.50.

CARE AND MANAGEMENT OF ELECTRIC POWER PLANTS. By Norman H. Schneider. Cloth, $1.50. Leather, $2.50.

INDUSTRIAL PHOTOMETRY, with Special Application of Electric Lighting. By A. Palaz, Sc.D. $4.

ELEMENTS OF ELECTRIC LIGHTING, Including Electric Generation, Measurement, Storage and Distribution. By Philip Atkinson. $1.50.

ELECTRIC TRANSMISSION OF ENERGY. By G. Kapp. $3.50.

ELECTRICIAN'S POCKET-BOOK. By Monroe and Jamieson. $2.50.

DYNAMO BUILDING. By F. W. Walker. 50 cents.

DOMESTIC ELECTRICITY FOR AMATEURS. By F. Hospitalier. $2.50.

PRACTICAL MANAGEMENT OF DYNAMOS AND MOTORS. $1.

PRACTICAL GUIDE TO THE TESTING OF INSULATED WIRES AND CABLES. $1.

ELECTRIC LIGHTING, by Francis B. Crocker. $3.

ELECTRIC LIGHT FITTING. $3.

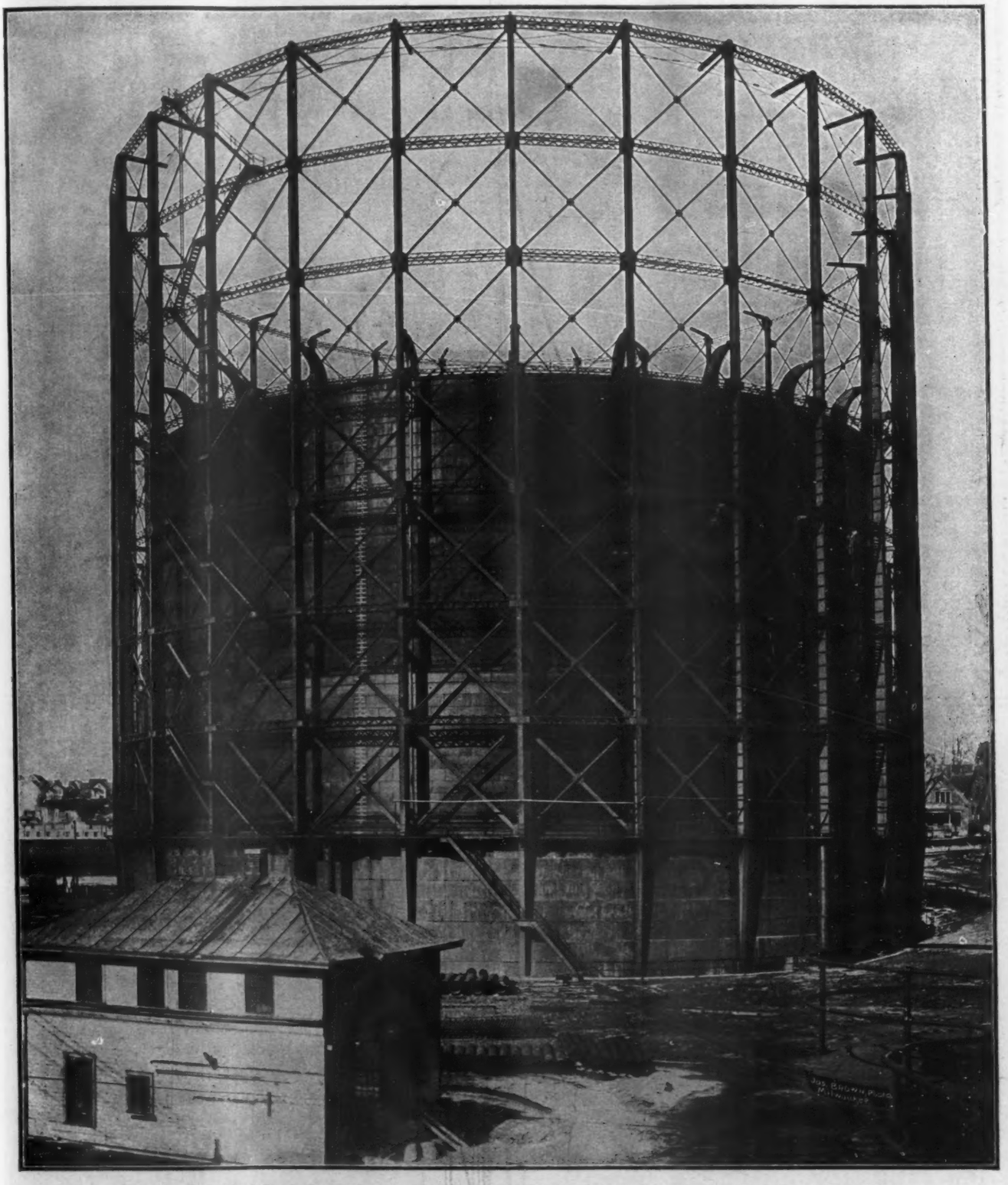
PRACTICAL ELECTRICITY. $2.50.

ELECTRICITY FOR ENGINEERS. $2.50.

ELECTRICITY, Its Theory, Sources and Applications. By John T. Sprague. $6.

The above will be forwarded upon receipt of price. If sent by mail or express, postage or express charges must be added to above prices. We take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances should be made by check, draft, or post office money order. No books sent C.O.D.

A. M. CALLENDER & CO., - - - - - 42 Pine Street, New York City.



The Largest Steel Tank Gasholder in the World, 225 Feet 9 Inches Diameter, 35 Feet Deep, Five Lifts.

RITER-CONLEY MFG. CO.,

PITTSBURGH.

PLATE AND STRUCTURAL WORK OF EVERY DESCRIPTION.

COMPLETE COAL GAS PLANTS.

CRUSE-KEMPER COMPANY,

Gas Engineers and Builders.

GAS HOLDERS.

Western Sales Agent:
HENRY I. LEA, 616 The Rookery, Chicago, Ills.

Pacific Coast Agents:
HALLIDIE MACHINERY CO., Seattle, Wash.

MAIN OFFICE AND WORKS, - - - - AMBLER, PA.

J. S. DeHART, JR., PRESIDENT
A. F. WEHNER, SECRETARY
R. K. WEHNER, TREASURER

ISBELL-PORTER COMPANY

GAS ENGINEERS & BUILDERS OF GAS WORKS

BENCH WORK

CHARGING AND DISCHARGING MACHINERY

MACKENZIE EXHAUSTERS

PRIMARY AND SECONDARY CONDENSERS FOR FRESH OR SALT WATER

ISBELL VALVES SPECIALS

TAR EXTRACTORS

P. & A. TAR EXTRACTORS FOR WATER GAS

ROTARY AMMONIA SCRUBBERS

SHAVING SCRUBBERS PURIFIERS STREET GOVERNORS

MAIN OFFICE AND WORKS
BRIDGE & OGDEN STREETS
NEWARK, N.J.
ESTABLISHED 1865

THE

Ludlow Valve Mfg. Co.,

TROY, N. Y., U. S. A.

Double and Single Gate Valves, ¼" to 72",

—FOR—

Gas, Water, Steam, Oil, Ammonia, Etc.

HOT GAS VALVES A SPECIALTY.

Send for Catalogue.

QUINTARD IRON WORKS,

N. F. PALMER,

Foot of 12th St. & East River, New York,

MANUFACTURERS OF

GAS APPARATUS.

Complete Works Erected.

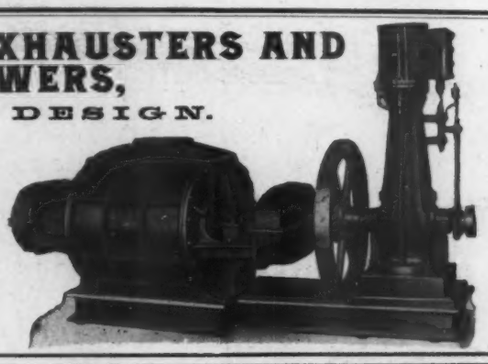
FREDERICK W. FLOYD, Engineer.

POSITIVE GAS EXHAUSTERS AND BLOWERS,

LATEST DESIGN.

Most Simple and Efficient Machine on the Market. Let us figure on YOUR requirements.

THE PIQUA BLOWER CO.,
PIQUA, OHIO.



ESTABLISHED 1856.

HENRY MAURER & SON,

Manufacturers of

High Grade Firebrick, Blocks, Tiles,

ETC.,

Works: Maurer, N. J. Office: 420 E. 23d St., N. Y. City

FIELD'S ANALYSIS FOR THE YEAR 1907.

An Analysis of the Principal Gas Undertakings in England, Scotland and Ireland; being the 39th year of publication. Compiled and arranged by JOHN W. FIELD, Sec'y and Gen. Mgr. of The Gas Light and Coke Company, London. Price, $5. For Sale by A. M. CALLENDER & CO., 42 Pine St., New York City.

THE BEST

GAS BENCHES.

"LACLEDE-CHRISTY."

BEST DESIGN,
BEST MATERIAL,
BEST WORKMANSHIP,
BEST RESULTS.

LACLEDE-CHRISTY CLAY PRODUCTS COMPANY,

ST. LOUIS, MO.

COAL TAR AND AMMONIA,

By GEORGE LUNGE, PH.D. Third and Enlarged Edition.
Price, $15. For Sale by
A. M. CALLENDER & CO., 42 Pine St., New York City.

LLOYD CONSTRUCTION COMPANY

GAS APPARATUS.

DETROIT – MICHIGAN

BEST IN THE WORLD.

Humphrey Instantaneous Bath Water Heaters

Should be used in every home. They make Hot Water **always** ready. Require no attention after installation. Hot water pours forth at any time upon lighting the gas. Close off the gas and all expense ceases. **Absolutely Guaranteed.**

Special Merits.

A burner that won't light back; a rust proof enameled shelf; a removable base plate for ready access to burner.

Shall we Send Catalog No. 9 and Discount?

HUMPHREY CO.,
Kalamazoo, Mich., U. S. A.

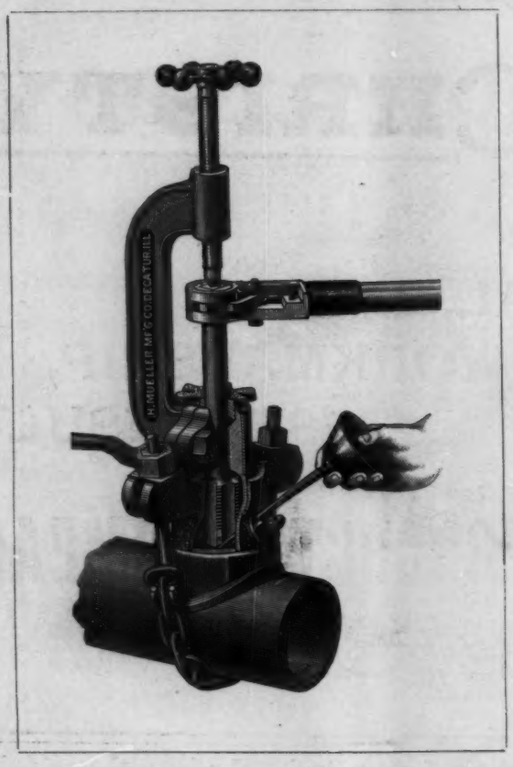
WRITE for our Catalogue "O" just issued. This Catalogue deals entirely with "Brownhoist" Machinery as used at Artificial Gas Plants for handling coal, coke and other materials rapidly and economically.

THE BROWN HOISTING MACHINERY COMPANY,

Designers and Builders of All Kinds of Hoisting Machinery.

Main Office and Works:
CLEVELAND, O.

Branch Offices:
NEW YORK AND PITTSBURG.



Mueller Gas Tapping Machines.

A salesman underbid all competitors, but failed to get the contract because he candidly explained "his company made its money on repairs."

That is a point to consider when you buy a tapping machine.

Mueller Gas Tapping Machines are sold at a fair price, are built for hard and lasting service and their cost of maintenance is a small item. We don't build them on the theory of making money out of repairs.

Eleven styles of tapping and drilling machines. Unconditionally Guaranteed.

TRADE MARK MUELLER REGISTERED

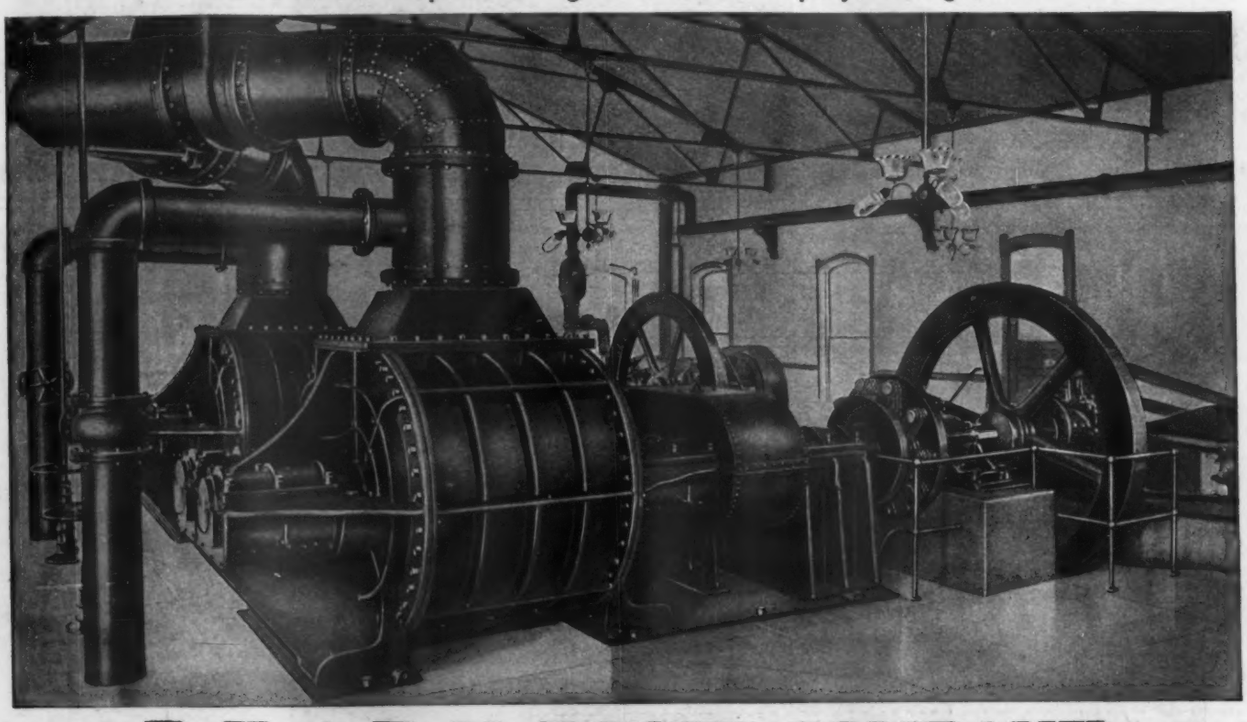
H. MUELLER MFG. CO.,

Works and General Offices,
DECATUR, ILL., U. S. A.
West Cerro Gordo St.

Eastern Division,
NEW YORK, N.Y., U. S. A.
254-258 Canal St. (cor. Lafayette).

ROOTS' EXHAUSTERS.

An installation of two units, each handling 800,000 cubic feet per hour, under 5 pounds per square inch, installed for the Peoples Gas Light and Coke Company, Chicago, Ills.



P. H. & F. M. ROOTS COMPANY,

HOME OFFICE: Connersville, Ind. NEW YORK OFFICE: 120-122 Liberty St. CHICAGO OFFICE: 1547 Marquette Bldg.

HUMPHREY ARC MANTLES are made in both single and double weave. Very likely you are prejudiced against double weave mantles. We were ourselves until our mantle makers showed us how good a really first-class double weave mantle is.

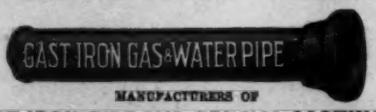
GENERAL GAS LIGHT CO.,

KALAMAZOO. NEW YORK. SAN FRANCISCO.

GEORGE ORMROD, Pres & Treas JOHN D. ORMROD, Supt.
J. G. EBERLEIN, Secretary.

EMAUS PIPE FOUNDRY.

DONALDSON IRON COMPANY. EMAUS, PA.



MANUFACTURERS OF

CAST IRON PIPE AND SPECIAL CASTINGS

FOR WATER AND GAS.

Also, FLANGE PIPE, LAMP POSTS, Etc.

THE BRISTOL CO.,

Manufacturers of BRISTOL'S

Recording Pressure Gauges, Recording Vacuum Gauges,
Recording Thermometers, Recording Voltmeters,
Recording Ammeters, Recording Wattmeters.

AND

THE WM. H. BRISTOL ELECTRIC PYROMETERS

AND

PATENT SMOKED CHART RECORDERS.

The **BRISTOL COMPANY,**
WATERBURY, CONN.

New York. BRANCH OFFICES. Chicago.

VULCAN ODORLESS GAS HEATERS,

For Artificial or Natural Gas.

Positively Odorless. We Guarantee this—Odorless.
These Heaters have been tested and endorsed by the leading Gas Experts and Chemists of this Country. Upon request we will send you booklet containing these endorsements.

The Perfect Gas Heater.

Patent Applied For.

The Cheerful Gas Heater

No. 338.

No. 330.

No. 334.

No. 330.—Shoaling Cone.

No. 348.

Write us for prices and our new catalog.

W. M. CRANE COMPANY,

Do you use Bray Burners? 1131-1133 Broadway, New York.

PARKER-RUSSELL MINING AND MFG. CO.,

ST. LOUIS, MO.

NEW YORK OFFICE: 45 Broadway.

GAS RETORTS AND FIREBRICK.

Benches.—We erect GAS RETORT BENCHES with Horizontal retorts having closed ends, or Through retorts up to 20 feet in length.

Slopers.—Also, SLOPERS on improved lines for Inclined Retorts.

Stoking Machinery.—Sole Agents for U. S. and Canada for the Fiddes-Aldridge Simultaneous Discharging Charger. The "F.A.," or "One-Stroke" Machine. Cost of Carbonizing reduced to minimum. No Dust. Silent. No Waste of Coal. No Injury to Retorts.

Water Gas Linings.—We make a specialty of WATER GAS BLOCKS, and supply brick of superior grade for checkerwork.

Retort Houses and Conveying Machinery.—We also build Retort Houses, Coal and Coke Conveying Machinery. Plans, specifications and estimates cheerfully furnished.

CORRESPONDENCE SOLICITED.

ALL CONTRACTS MADE AS OF ST. LOUIS.

Directory of American Gas Companies, 1908.

Price, $5.00.
For Sale by
A. M. Callender & Co., 42 Pine St. N.Y.

AMERICAN METER CO.,

NEW YORK, ST. LOUIS, PHILADELPHIA, SAN FRANCISCO, CHICAGO,

Photometrical and Experimental Apparatus.

PUBLIC LIGHTING TABLE.

SEPTEMBER, 1908.

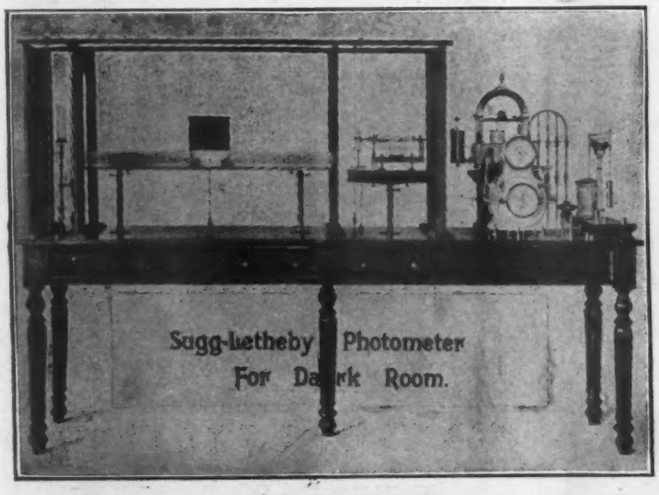
Table No. 1.
FOLLOWING THE MOON.

Day of Week.	Date.	Light.	Extinguish.
Tue.	1	8.30 PM	4.30 AM
Wed.	2	9.10	4.30
Thu.	3	9.50 FQ	4.30
Fri.	4	10.30	4.30
Sat.	5	11.30	4.30
Sun.	6	12.40 AM	4.30
Mon.	7	1.50	4.30
Tue.	8	3.10	4.30
Wed.	9	No L.	No L.
Thu.	10	No L FM	No L.
Fri.	11	No L.	No L.
Sat.	12	6.50 PM	8.50 PM
Sun.	13	6.40	9.30
Mon.	14	6.40	10.00
Tue.	15	6.40	10.30
Wed.	16	6.40 LQ	11.10
Thu.	17	6.40	12.00
Fri.	18	6.40	12.50 AM
Sat.	19	6.40	1.40
Sun.	20	6.30	2.40
Mon.	21	6.30	3.40
Tue.	22	6.30	4.50
Wed.	23	6.30	4.50
Thu.	24	6.30	4.50
Fri.	25	6.30 NM	4.50
Sat.	26	6.30	4.50
Sun.	27	6.20	4.50
Mon.	28	6.20	4.50
Tue.	29	6.20	4.50
Wed.	30	7.50	4.50

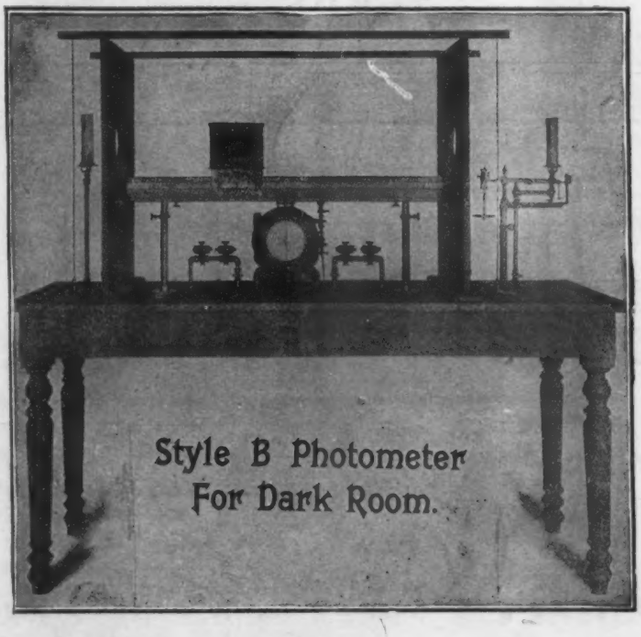
TOTAL HOURS DURING 1908.

By Table No. 1.

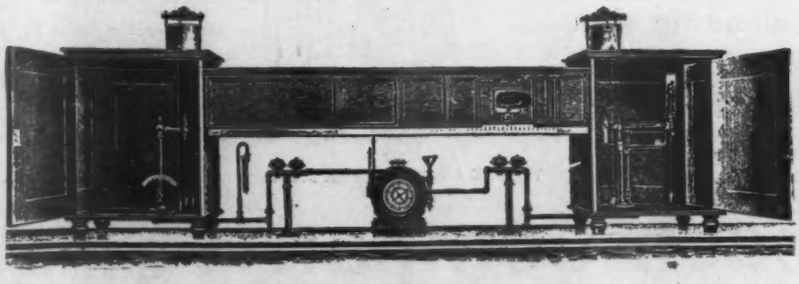
	Hrs.Min.
January	228.30
February	187.30
March	192.00
April	160.10
May	155.10
June	138.00
July	155.50
August	173.40
September	185.20
October	214.00
November	218.10
December	226.40
Total, yr.	2235.00



Sugg-Luetheby Photometer For Dark Room.



Style B Photometer For Dark Room.



Closed Photometer For Light Room.

CIRCULARS SENT ON REQUEST.

PUBLIC LIGHTING TABLE.

SEPTEMBER, 1908.

Table No. 2.
NEW YORK CITY.
ALL NIGHT LIGHTING.

Day of Week.	Date.	Complete Lighting in One Hour	Complete Extinguishing in 50 Minutes
		From Time Given	
		P. M.	A. M.
Tue.	1	6.27	3.57
Wed.	2	6.27	3.57
Thu.	3	6.17	4.07
Fri.	4	6.17	4.07
Sat.	5	6.17	4.07
Sun.	6	6.17	4.07
Mon.	7	6.12	4.07
Tue.	8	6.12	4.07
Wed.	9	6.12	4.07
Thu.	10	6.02	4.17
Fri.	11	6.02	4.17
Sat.	12	6.02	4.17
Sun.	13	6.02	4.17
Mon.	14	6.02	4.17
Tue.	15	6.02	4.17
Wed.	16	6.02	4.17
Thu.	17	5.52	4.27
Fri.	18	5.52	4.27
Sat.	19	5.52	4.27
Sun.	20	5.52	4.27
Mon.	21	5.47	4.27
Tue.	22	5.47	4.27
Wed.	23	5.47	4.27
Thu.	24	5.37	4.37
Fri.	25	5.37	4.37
Sat.	26	5.37	4.37
Sun.	27	5.37	4 37
Mon.	28	5.32	4.37
Tue.	29	5.32	4.37
Wed.	30	5.32	4.37

TOTAL HOURS DURING 1908.

	Hrs.Min.
January	481.50
February	329.15
March	351.50
April	341.50
May	233.05
June	218.10
July	282.55
August	254.55
September	292.25
October	420.45
November	374.30
December	411.05
	3992.35
Deduct on account of 50 min. extinguishing time	30.30
Total, yr.	3962.05

NEW YORK, 318 West 42d Street. BOSTON, 820 Beacon Building. PHILADELPHIA, Broad and Arch Streets. ST. LOUIS, 712 Roe Building. CHICAGO, 218 La Salle Street. SAN FRANCISCO, 512 Oak Street.

WELSBACH STREET LIGHTING COMPANY

....OF AMERICA....

No. 36.

Controls and Operates the **Welsbach System of Street Lighting,**

Which includes its specially DESIGNED and PATENTED BURNER for PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others interested in Municipal and Outside Lighting.

No. 38.

The Chic Light.

ONE OF THE MOST POPULAR AND BEST SELLERS OF THE WELSBACH LINE.

For decorative appearance and large volume of light at a popular price to the consumer,

THE CHIC LIGHT

is practically alone in the field. Complete satisfaction to the user is its strong point.

THE CHIC LIGHT—Design No. 71310.

PRICES:

Boxed complete, with No. 71 Welsbach burner, No. 310 F. Q. M. cylinder, No. 196 Junior J Brand Welsbach mantle, including the No. 316 opal shade, which will be packed separately.

Price, complete, clear cylinder, each, dozen lots, ... $1.35
Price, complete, clear cylinder, 100 lots, each, ... 1.25

When supplied with **No. 310 F. Q. M. Opal Cylinder** add 10 cents to above list.

Price of Shade No. 316.
Package Contains 16 Dozen.

Price, per dozen, ... $4.40
Price, original package, per dozen, . 4.00

WRITE FOR DISCOUNTS.

Welsbach Company, FACTORIES: Gloucester, N. J. Chicago, Ills.

Salesrooms in all Leading Cities of the United States.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

LESSEES, OPERATORS AND BUILDERS OF **GAS WORKS.**

Largest Builders of CARBURETTED WATER GAS PLANT IN AMERICA.

SOLE AMERICAN BUILDERS

OF THE

Standard Double-Superheater Lowe Water Gas Apparatus.

1907 CONTRACTS.

PARTIAL LIST OF PLACES:

Newburgh, N. Y.
Helena, Mont.
Bridgeport, Conn. (3d contract).
Suffolk, Va.
Winsted, Conn. (2d contract).
Nashua, N. H.
Augusta, Me. (2d contract).
Everett, Mass.
Jenkintown, Pa. (2d contract).
Coney Island, N. Y.
Mexico, Mo.
Jacksonville, Fla.
Syracuse, N. Y. (2d contract).
Atlanta, Ga. (2d contract).
Holyoke, Mass.
Peoria, Ills.
Schenectady, N. Y. (2d contract).
Danbury, Conn.
Galveston, Tex. (2d contract).
Quebec, Canada.
Indianapolis, Ind. (2d contract).
Bessemer, Ala.
Waterbury, Conn. (5th contract).
Sioux Falls, S. D. (3d contract).
Philadelphia, Pa.
New Hartford, Conn.
Poughkeepsie, N.Y. (2d contract).
Nashville, Tenn.
Salisbury, Md.
Norfolk, Va. (4th contract).
Wallingford, Conn.
Richmond, Va. (2d contract).
Oak Bluffs, Mass.
Arlington, Mass.

TOTAL SETS INSTALLED DURING YEAR, ... 43
TOTAL SETS INSTALLED TO DECEMBER 31, 1907, ... 677
TOTAL DAILY CAPACITY, TO DECEMBER 31, 1907, ... 545,865,000 cu. ft.

Tar Extractors for Carburetted Water Gas.
Photometrical Apparatus.
Gas Analysis Apparatus.
Recording Gauges.
Straight Standpipe System for Coal Gas Retorts.
Straight Standpipe Cleaners.
Waste Heat Boiler.
Hygrometer.
Venturi Meter for Measuring Flow of Air Blast.

Established 1858. Incorporated 1890.
CHAS. E. GREGORY, Prest. DAVID R. DALY, V.-Prest. & Treas.
H. D. ABERNETHY, Sec.

J. H. Gautier & Co.

Greene & Essex Streets,
Jersey City, N. J.

MANUFACTURERS OF

CLAY GAS RETORTS, FIRE CLAY TILES, FIRE BRICK and FIRE CLAY SPECIALTIES.

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

SOLE MANUFACTURERS OF THE

FLEMMING GENERATOR GAS FURNACE

ELECTRIC GAS LIGHTING.

How to install electric gas igniting apparatus, including the jump spark and multiple systems for use in houses, churches, theaters, halls, schools, stores or any large building. Also, the care and selection of suitable batteries, wiring and repairs.

By H. S. NORRIE.

Price, 50 cents. Orders may be sent to

A. M. CALLENDER & CO., 42 PINE ST., N. Y. CITY.

Practical Photometry,

By William Joseph Dibdin.

Price, ... $3.00.

FOR SALE BY

A. M. CALLENDER & CO.
42 Pine St., New York City.

ESTABLISHED 1868.

L. N. RANCKE, Vice-Pres. & Mgr. F. SCHIAFFINO, Sec'y & Treas.

BALTIMORE RETORT & FIREBRICK CO.

BALTIMORE, MD.,

Manufacturers of all Material for the Construction of Coal Gas Benches.

HALF AND FULL DEPTH AND FREE FIRING BENCHES,

All styles of which we have in operation, equipped with the BEST of LATEST IMPROVEMENTS, proving our claim for SUPERIOR QUALITY and EFFICIENCY.

INCLINES—We have in SUCCESSFUL OPERATION benches of Inclined Retorts, MANUFACTURED and ERECTED by us.

WALDO BROS., 103 MILK ST., BOSTON, MASS.,
Agents for New England States.

LARGE FACILITIES—Correspondence Solicited.
RAIL and WATER CONNECTIONS to ALL POINTS.

L. C. HAMLINK, PRES. AUGUST COURT, SEC'Y.

GAS BENCH CONSTRUCTION COMPANY,

METROPOLITAN BUILDING, ST. LOUIS, MO.,

Engineers and Builders of all styles of Standard and Special Benches from one to twelve Retorts, Horizontal, Vertical, or Inclined.

We will guarantee "Better Benches," to be easier to control, make more gas per retort, and operate with less fuel than any bench on the market.

ALL WORKMANSHIP AND MATERIAL GUARANTEED.

JOHN DELL, *President and General Manager.*

MISSOURI FIRE BRICK CO.,

ESTABLISHED 1882.

MANUFACTURERS OF

Gas Retorts, Bench Settings, Fire Brick, Cupola Linings, Etc.

We are the **Exclusive Agents** *for the* **Mitchell Patent Benches,** *Constructed with Half or Full Depth Furnaces, to Burn either Coal or Coke, and Arranged for Front or* **Rear Clinkering.** **The Mitchell** *is the* **Original Coal Firing Bench.** *We also Erect Plain Benches with* **One** *to* **Six Retorts.**

YOUR CORRESPONDENCE IS RESPECTFULLY SOLICITED.

City Office: *411 Olive Street, Continental Bank,* ST. LOUIS, MO.

PRACTICAL HANDBOOK ON GAS ENGINES, WITH INSTRUCTIONS FOR CARE AND WORKING OF THE SAME,

By G. LIECKFELD, C.E. Translated with Permission of the Author, by GEORGE M. RICHMOND, M.E. Price, $1.

For Sale by A. M. CALLENDER & CO., 42 Pine St., New York City.

Bronder Patent Stoking Machinery.

Three-Scoop and Three-Rake Charging and Discharging Machines are operating in New York, Newark, N. J., Philadelphia, Worcester, Mass., Mt. Vernon, N. Y., Toronto and Montreal, Canada, Detroit, Seattle, Rochester and St. Louis.

Four-Scoop and Four-Rake Charging and Discharging Machines are operating in Detroit, Mich., and Cincinnati, Ohio. These are the only machines that will draw or charge simultaneously 3 or 4 retorts (vertically) and handle from 42 to 60 retorts in from 25 to 30 minutes, lid opening and closing and filling of furnaces included.

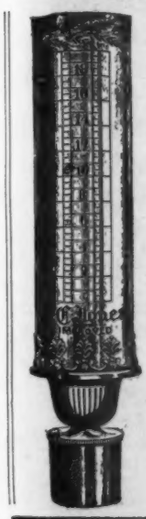
Hot Coke Conveyor, Quencher and Steam Exhauster, operating in Toronto, Canada, working in water-sealed flue, rollers being protected from heat and grit.

COAL CRUSHERS, CONVEYORS AND BINS. TURNTABLES FOR MACHINES.

Labor-Saving Machines for Handling Coal and Coke from Coal Cars to Coke Yard or Bins. Coke Screening and Measuring Plants a Specialty.

G. A. BRONDER,
Contracting Engineer and Builder,
229 BROADWAY, NEW YORK.

CONNELLY IRON SPONGE AND GOVERNOR CO.,



Automatic, Balance, High Pressure and Service Governors,

Unison Telemetric Pressure Gauge,

Iron Sponge, Purifying Material for Gas Purification, Manufacturers of Jones Jet Photometers, The National Smoke and Ammonia Helmet, Pressure Regulators, etc.

Wide Experience in High Pressure Installation and Extension.

50 CHURCH STREET, NEW YORK CITY.
295 WEST 22D STREET, CHICAGO, ILLS.

12-inch High Pressure Governor.

REYNOLDS' GAS REGULATOR COMPANY,

ANDERSON, IND., U. S. A.

We make all sizes for all classes of reduction,

Double and Single District Stations,

And Individual Service Governors for Reducing High Pressure.

HOLDER GOVERNORS

And Low Pressure Regulators, all of the Dry Diaphragm type.

English Agents:
THE BRYAN DONKIN CO., LTD., Chesterfield, England.

Write for Catalog.

Combination Governor.
(Governor and Mercury Seal.)

AWARDED A SILVER MEDAL AT THE WORLD'S FAIR, ST. LOUIS, 1904.

SAFETY GAS MAIN STOPPER CO.,

257-263 East 133d Street,
NEW YORK CITY.

PATENTS, TRADE MARKS, COPYRIGHTS.

ROYAL E. BURNHAM,

Solicitor of Patents and Counsellor in Patent Causes.

833 Bond Building, Washington, D. C.

Send for Pamphlet on Patents.

JAMES D. PERKINS, President. F. SEAVERNS, Treasurer.

THE PERKINS COMPANY,

228 and 229 Produce Exchange, New York City.

OCEAN MINE YOUGHIOGHENY GAS COAL,
OLD KENTUCKY SHALE AND O. K. BOGHEAD.

BERWIND-WHITE COAL MINING COMPANY'S

Ocean Westmoreland Gas Coal.

Offices:
Washington Building, New York.
Betz Building, Philadelphia.

STRICTLY High Grade. . . . .
Carefully Prepared.
For Gas Making or
Heavy Steaming. .

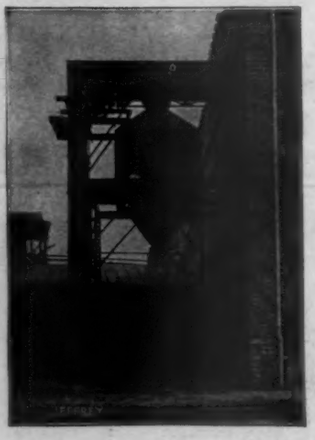
A. C. M. AZOY, General Agent, 1 Broadway, New York.

NAPHTHALENE SOLVENT.

Cheap and Efficient.

For Use in Works, Mains and Service Pipes. Shipped in 100-gallon Drums.

Semet-Solvay Co.,
(P. O. Box 1)
SYRACUSE, N. Y.



JEFFREY
COAL AND ASHES HANDLING SYSTEMS
for
Power Plants.

Overlapping Pivoted Bucket Conveyers,
"Century" Rubber Belt Conveyers,
Grab Bucket Hoisting Towers,
Steel Storage Bins, Screens,
Telescoping Ashes Elevators,
Crushers, Pulverizers, etc.

ECONOMY, INCREASED CAPACITY, LARGER DIVIDENDS.

THE JEFFREY MFG. CO.,
COLUMBUS, OHIO, U. S. A.

New York.	Chicago,	Boston,
Pittsburg,	Denver,	Charleston,
Knoxville,	St. Louis,	Montreal.

Jeffrey Pivoted Bucket Conveyer over Coal Bunkers.

ISAAC C. BAXTER, President. ESTABLISHED 1864. PETER YOUNG, Secretary and Treasurer.

Works, LOCKPORT STATION, PA.

JAMES GARDNER, JR., CO.,

Address all communications to JAMES GARDNER, JR., CO., Bolivar, Pa.

Successor to WILLIAM GARDNER & SON.

Fire Clay Goods for Gas Works.

GAS ANALYST'S MANUAL. By JAQUES ABADY. Price, $6.50. For Sale by A. M. Callender & Co., 42 Pine St., N. Y. City.

KELLER ADJUSTABLE COKE CRUSHER.

Strong, Simple, Durable. Will Crush any Size Desired.

C. M. KELLER,
Sec. & Supt. Gas Lt. & Coke Co.,
Columbus, Ind.
Correspondence Solicited.

THE ECONOMICAL GAS APPARATUS CONSTRUCTION COMPANY, LIMITED,

Consulting Engineers.

Builders of UP-TO-DATE Machinery and Appliances for Coal and Water Gas Plants. :: :: :: :: ::

PLANS,
SPECIFICATIONS
AND ESTIMATES
PREPARED.

AMERICAN OFFICE:
269 Front St., East, Toronto, Canada.

Edmund H. McCullough, President. H. C. Adams, Vice-President. Chas. F. Godshall, Treasurer. Henry Wharton, Secretary. C. B. Nichols, Assistant Secretary.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Pa.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J.,
WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.

GAS MAINS—SERVICE PIPES.

Their installation for High or Low Pressure is the work in which we have specialized for years. Because of our Facilities and Experience, many Gas Companies prefer to contract with us for such work, rather than to execute it themselves. It proves to be as cheap in the end. We solicit inquiries.

Telephone Connection.

SULLIVAN BROS.,
11 Main St., Flushing, N. Y.

JOHN CABOT, President. GEO. O. CABOT, Secretary

1412-1428 Adams Street, Hoboken, N. J.

PURIFIER AND SCRUBBER TRAYS.

Church's Patent Trays,

Reversible; Strongest; Most Easily Repaired.

We also Supply the Cheapest and Strongest

Reversible Bolted Trays.

Special Trays for Iron Oxide in Either Style.

GAS TAPPING MACHINES

—FOR—

Drilling and Tapping Pipe under Pressure

WITHOUT ANY ESCAPE OF GAS.

They are Strong and Compact.

Size of Combination Drills and Taps ¾ to 4-inch.

Machines Sent to any Gas Company for Thirty Days' Trial.

Send for Circulars.

Geo. Light,
DAYTON, O.

Modern Machine Shop Construction, Equipment and Management, by OSCAR E. PERRIGO, M.E.

Price, $5. For Sale by
A. M. CALLENDER & CO., 42 Pine St., New York City.

Alcohol, its Manufacture from Farm Products and De-Naturing. By F. B. WRIGHT.

Price, $1. *For Sale by*
A. M. Callender & Co., 42 Pine St., New York City.

Gas Engineer's Pocket-book, —BY— HENRY O'CONNOR,
Comprising Tables, Notes and Memoranda relating to the Manufacture, Distribution and Use of Coal Gas, and the Construction of Gas Works. PRICE, $3.50. For Sale by
A. M. Callender & Co., 42 Pine St., New York City.

AMERICAN GAS ENGINEERING PRACTICE,

A HANDBOOK FOR ALL ENGAGED IN THE INDUSTRY,

Comprising Many Details Not Heretofore Published,

By M. NISBET LATTA, C.E.,

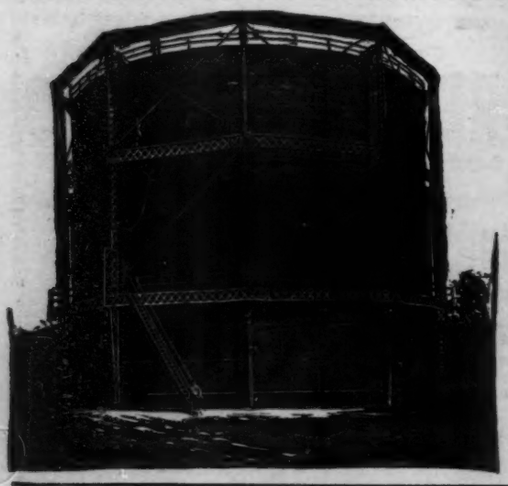
PART I. WATER GAS MANUFACTURE. The Generator. The Carburetter. The Superheater. Wash Box and Tar. Scrubbers. Condensers. Purifiers. Exhausters. Station Meters. Holders. Details of Works' Operation.

" II. GAS DISTRIBUTION. Naphthaline. Mains. Services. Consumers' Meters. Pressure. House Piping. Appliances.

" III. GENERAL TECHNICAL DATA. Properties of Gases. Steam. Mathematical Tables. Conversion Factors. Pipe and Miscellaneous Data.

Price, $4.50. For Sale by

A. M. CALLENDER & CO., 42 PINE ST., NEW YORK CITY.



DAVIS & FARNUM MFG. CO.,
Principal Office and Works, Waltham, Mass.

Single, Double and Triple-Lift Gasholders of any Capacity. Tubular, Pipe and Sinuous Friction Condensers of all Sizes.

Steel Tanks for Gasholders, Iron Roof Frames and Floors, Purifying Boxes, Center Seal or Valve Connections, Bench Work, Reversible Lime Trays.

Self-Sealing and Pressed Steel Mouthpiece Lids.

Coke Barrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Works.

Also, Gas and Water Pipe, Flanged Pipe, Sugar House Work, and Special Castings of all Descriptions.

H. M. BYLLESBY & COMPANY
(INCORPORATED).

GAS ENGINEERS,

DESIGN, CONSTRUCT AND OPERATE
COMPLETE COAL, WATER AND CRUDE OIL GAS PLANTS.

EXAMINATIONS AND REPORTS.

AMERICAN TRUST BUILDING
CHICAGO.

Oklahoma City, Okla. Mobile, Ala. San Diego, Cal.

ALEX. C. HUMPHREYS, M.E., M. Inst. C.E. ARTHUR G. GLASGOW, M.E., M. Inst. C.E.

HUMPHREYS & GLASGOW,
CONSULTING ENGINEERS.

CITY INVESTING BUILDING,
165 Broadway,
New York.

38 VICTORIA STREET,
London, S. W.,
England.

ADVICE AS TO EXTENSION AND RECONSTRUCTION OF GAS AND ELECTRICITY PLANT.

COMPLETE EXAMINATIONS MADE.

PROPERTIES PURCHASED.

No. 0721. Coal Storage at the St. Paul Gas Light Company. Automatic railway car taking coal from an overhead hopper.

Coal and Coke Handling Machinery for Gas Works,

including

Coke Larries, "Industrial" Railways,
Hoisting Towers, Cable Railways,
Elevators, Automatic Railways,
ETC.

This type of machinery is a specialty with us, and we want you to write and let us tell what it will do for you and what it will save you. Experience extending over 36 years is bound to be useful.

C. W. HUNT COMPANY
(Established 1872).

West New Brighton, New York.
New York Office, 45 Broadway.

"THE MINER"
Globe Street and Boulevard Lamps.

Cheapest and Best
THOUSANDS IN USE WITH INCANDESCENT BURNERS.
Send for Catalogues.

THOMAS T. W. MINER,
821-823 Eagle Av., N.Y.

Practical Handbook on
GAS ENGINES,
With Instructions for Care and Working of the Same,

By G. LIECKFELD, C.E.
Translated with Permission of the Author,
By GEO. M. RICHMOND, M.E.

Price, $1.

For Sale by
A. M. CALLENDER & CO.,
42 Pine Street, - - - - New York City.

SELF-INSTRUCTION
For Students in Gas Manufacture,
ELEMENTARY, ADVANCED AND CONSTRUCTIONAL.

Three Volumes. Price, $1.50 each. For Sale by
A. M. Callender & Co.,
42 Pine Street, New York City.

Bartlett, Hayward & Company,

Baltimore, Md. 100 Broadway, New York.

GASHOLDERS,

Coal and Water Gas Plants.

KERR MURRAY MANUFACTURING COMPANY,

Engineers and Manufacturers

APPARATUS FOR COAL GAS PLANTS,

SINGLE AND DOUBLE-LIFT GASHOLDERS
AND STEEL TANKS,

Latest Improved

ROTARY EXHAUSTERS, P. & A. TAR EXTRACTORS, AMMONIA WASHERS,

CONDENSING, SCRUBBING AND PURIFYING APPARATUS.

Street Specials and Valves.

ADDRESS:

KERR MURRAY MANUFACTURING COMPANY, {FORT WAYNE, IND

R. D. WOOD & CO.,

400 CHESTNUT ST., PHILADELPHIA,

MANUFACTURERS OF

Cast Iron Pipe.

HEAVY LOAM CASTINGS,

Dunham Specials,

Hydraulic Work,

LAMP POSTS, VALVES, ETC.,

Gas Power Plants with Producers.

BUILDERS OF

Gasholders.

Single or Multiple Lifts, with or without Metal Tanks.

PURIFIERS, CONDENSERS, SCRUBBERS, BENCH WORK.

Cutler's Patent Freezing Preventer for Holder Cups.

Double Gate Valves.

A LARGE STOCK ON HAND READY FOR PROMPT SHIPMENT.

These valves are provided with double discs or gates, and are tight with the gas pressure on either side of them.

The discs are so arranged as to be free from their seats when being opened or closed, and are operated by a quick-acting mechanism. The valve stem extends outside of the bonnet, and serves as an index, showing whether the valve is closed or open, and the amount of opening. They are made of the following dimensions:

Size.....	8 inches	10 inches	12 inches	16 inches	20 inches	24 inches	30 inches	36 inches
Diameter of flanges....	13 inches	16 inches	18 inches	22½ inches	27 inches	31 inches	31½ inches	44 inches
Face to face of flange...	12 inches	12 inches	12 inches	14 inches	17 inches	20 inches	21 inches	23¾ inches

For price and other information, apply to

THE CONTINENTAL IRON WORKS,

P. O. STATION G. NEW YORK (BOROUGH OF BROOKLYN).

FRANK D. MOSES,

Telephone, 1503-D TRENTON, N. J., Telephone, 1503-D

Constructing Engineer and Contractor.

Estimates Furnished on any kind of Work in Connection with Gas or Water Plants.

SPECIAL ATTENTION GIVEN TO THE REMODELLING AND EXTENDING OF THE PROPERTIES OF WORKS NOT UP-TO-DATE.

CORRESPONDENCE SOLICITED.

GEROULD'S IMPROVED RETORT CEMENT.

A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

Price List, f.o.b. PITTSBURGH, PA.

In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 100 to 200 " " 6 " "
In Kegs less than 100 " " 7 " "

C. L. GEROULD,

1200 Bank for Savings Bldg., Pittsburgh, Pa.

PERFECT GAS MAIN STOPPERS.

Simplest, Easiest, Best.

Cannot Slip.

EDWARD A. BEHRINGER, SOLE MANUFACTURER, 82 Warren Street, New York City.

Established 1851. Incorporated 1880.

THE STACEY MANUFACTURING CO.,

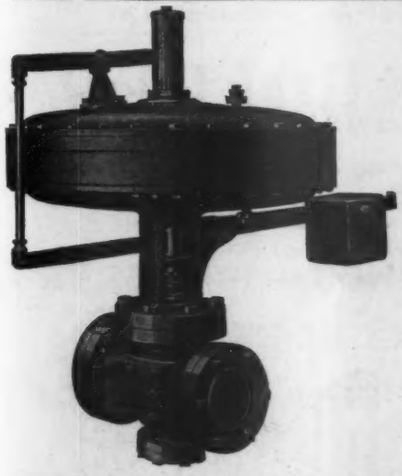
Gas Engineers and Builders.

Gas Holders.

All Ironwork and Apparatus Required in a Gas Plant Valves and Specials.

Executive Office and Works, - - - - Station P, Cincinnati.
Western Office, - - - - - 519 Eddy Street, San Francisco.

Correspondence Solicited.



THE FULTON GAS PRESSURE GOVERNORS

For Artificial or Natural Gas.
For District or Individual Service.

Our Improved **Duplex Sensitive Governor** for district service will reduce high pressure gas to inches of water without variation. Absolutely safe and reliable. No complicated mechanism to get out of order. No auxiliary regulators or other devices to assist the main governor required. The most simple and perfect governor ever placed on the market. We also manufacture Holder Governors, Compressor Governors and Individual Service Governors for any inlet and outlet pressure.

More than 20 years' experience with the largest gas companies. Send for Catalog.

THE CHAPLIN-FULTON MFG. CO.,
28-34 PENN AVE., PITTSBURGH, PA.

ALCOHOL, Its Manufacture from Farm Products and De-Naturing,

By F. B. WRIGHT.

A NEW AMERICAN BOOK.

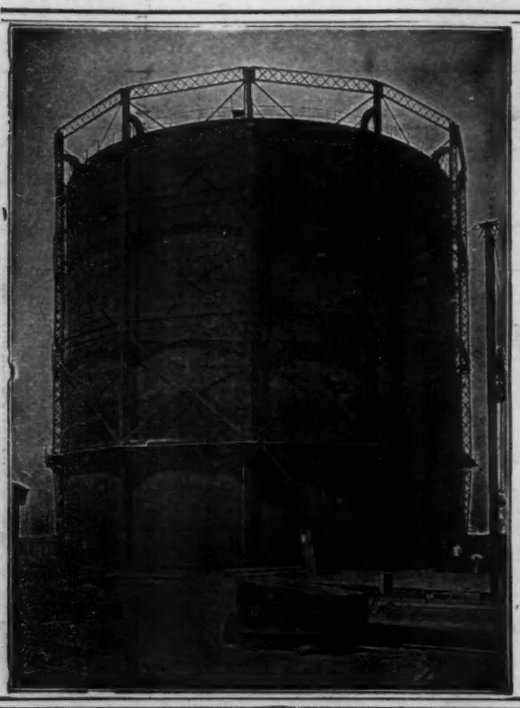
CONTENTS.

Chapter 1. Alcohol, its various forms and sources.
" 2. Mashing, cooling and fermentation in general.
" 3. Distillation, simple forms of stills, the production of Alcohol from wine.
" 4. Malting.
" 5. Alcohol from Potatoes, mashing, fermentation, distillations, Continuous stills.
Chapter 6. Alcohol from Grain.
" 7. Alcohol from Beets.
" 8. Alcohol from Sorghum and Molasses.
" 9. De-natured Alcohol and its Commercial uses.
" 10. Alcoholometry. Index.

Fully Illustrated with Original Drawings of Necessary Apparatus.

PRICE, $1. For Sale by

A. M. CALLENDER & CO., 42 PINE ST., NEW YORK CITY.



JOHN FOWLER, President. J. SCOTT FOWLER, Vice-Pres. & Treas.

DEILY & FOWLER MFG. CO.,

39 Laurel Street, Philadelphia, Pa.

ESTABLISHED, 1842. INCORPORATED, 1908.

BUILDERS OF

GASHOLDERS,

Single-Lift or Telescopic,

With or Without Steel Tanks.

Oil Storage Tanks, Water Tanks, Etc.

ESTIMATES CHEERFULLY FURNISHED.

CORRESPONDENCE SOLICITED.

The order for this Triple-LIFT Holder and Steel Tank was received by the Logan Iron Works from the Union Gas Light Company, of East New York. The contract was completed and the Holder was in actual use in 90 days from receipt of order. Capacity of Holder, 500,000 cu. ft.

LOGAN IRON WORKS,

Brooklyn, N. Y.,

MANUFACTURERS OF

Single or Multiple-Lift

GASHOLDERS,

Complete, with Steel Tanks.

BENCHES, SCRUBBERS,

CONDENSERS,

PURIFIERS, IRON ROOFS,

AND ALL PARTS OF

GAS WORKS APPARATUS.

Contractors for

Complete Works.

FREDERIC EGNER,

Gas Engineer,

NORFOLK, VA.,

May be consulted with reference to estimates of cost for new, or appraising actual value of existing works; utility of proposed or patented processes; relative earning power to capitalization, and management.

GAS ANALYST'S MANUAL,

By JAQUES ABADY, M. Inst. Mech. E.

(Incorporating F. W. Hartley's "Gas Analyst's Manual" and "Gas Measurement.")

Ninety-three Illustrations and Nine Folding Plates. Bound in Handsome Half Leather. Price, $6.50.

For Sale by A. M. CALLENDER & Co., 42 Pine St., New York City.

D. McDONALD & CO.,

971-997 BROADWAY, ALBANY, N. Y.,

MANUFACTURERS OF

DRY GAS METERS, STATION METERS, PREPAYMENT METERS, METER PROVERS AND GAUGES.

THE GLOVER PREPAYMENT METER,

Simple, Strong, Satisfactory.

THE HINMAN STATION METER DRUM,

The greatest advance that has been made in 20 years in the ACCURATE and ECONOMICAL measurement of gas in large quantities. :: :: ::

NEW YORK OFFICE: 561 West 47th Street. | ALBANY OFFICE: 991 Broadway. | CHICAGO OFFICE: Jefferson and Monroe Streets.

"IRONCLAD"

Gas Meters for Artificial or Natural Gas

Possess all the desirable features of the regular tin meters, in addition to having outer case of cast iron.

Valve seats and tangent support cast in one piece, securing absolute alignment of valve seat and valve, assuring positive and accurate operation.

No stuffing box under worm and tangent.

Old-time flat rotary valve displaced by regular pattern slide valves.

Diaphragms do not buckle, but move forward and back in straight line.

Large Capacity.
Low Absorption.

Write for prices. Meters furnished for trial and test.

Pittsburg Meter Co.

East Pittsburg, Pa.

New York Office, 149 Broadway.

BINDER

FOR THE

JOURNAL.

PRICE, $1.

FOR SALE BY

A. M. CALLENDER & CO., - 42 Pine St., New York.

NATHANIEL TUFTS METER COMPANY,

455 Commercial St., Boston, Mass.

PREPAYMENT GAS METERS,
WET AND DRY GAS METERS, STATION METERS, ETC.

REPAIRING OF ALL MAKES OF METERS, AND FITTED WITH OUR PREPAYMENT ATTACHMENT.

B

METERS.

INCREASED CAPACITY.
INCREASED EFFICIENCY.

PREPAYMENT METERS, STATION METERS, METER PROVERS, ETC.

PROMPT AND CAREFUL ATTENTION TO ALL **REPAIR WORK.**

MARYLAND METER COMPANY,

BALTIMORE. — CHICAGO.

YOU NEED ONE OR MORE OF OUR COMPLAINT METERS.

METERS, Plain and Prepayment,

For Artificial or Natural Gas.

Repairing All Makes and Attachments Added if Desired.

SPECIAL METERS FOR ACETYLENE.

KEYSTONE METER COMPANY,

ROYERSFORD, PA.

JUDICIOUS ECONOMY IS EFFECTED

BY USING

5-L. IMPROVED GAS METERS.

LOW SPEED, LARGE DIAPHRAGMS,
STRONGER CONSTRUCTION.
LARGER CAPACITY.

FITTED WITH

THE NEW YORK PREPAYMENT ATTACHMENT.
STEEL BOX AND CABINET LOCK. :: :: ::

NEW YORK IMPROVED METER CO., 306-310 East 47th St., New York City.

AMERICAN METER CO.,

NEW YORK, ST. LOUIS, PHILADELPHIA, SAN FRANCISCO, CHICAGO,

Wet and Dry Gas Meters, Station Meters, Meter Provers,
Photometrical Apparatus, Gauges,

PREPAYMENT METERS,

REGULAR METERS REFITTED WITH PREPAYMENT ATTACHMENTS.

HELME & McILHENNY,

Established 1848. **1339 to 1349 Cherry Street, Philadelphia, Pa.**

MANUFACTURERS OF

Wet and Dry Gas Meters, Station Meters, Provers, Gauges, Etc.

METERS REPAIRED

PREPAYMENT GAS METERS.

Our Own Patents. Strong. Simple. PROMPT ATTENTION. CORRESPONDENCE SOLICITED.

HOW'S YOUR METER'S LUNGS?

INLET AT TOP.

PATENTED MAY 13, 1902.

Diaphragms are to meters what lungs are to men. Condensation is to a diaphragm what Tuberculosis is to the lungs. The worse the disease the sooner the finish. The functions of both are destroyed eventually. One may never be replaced, the other, the diaphragm, may be, but at considerable cost. The way to avoid this is to use a

"SELF-DRAINING METER,"

Guaranteed free of Repairs for two years. Condensation never reaches diaphragm, insuring longer life.

ALWAYS ACCURATE.

Low speed. Extra Heavy Tin Used. Thoroughly Seasoned Diaphragm.

SAVES OVER 75 PER CENT. IN ANNUAL COST REPAIRS.

LARGEST CAPACITY of any METER MADE.

Write me for price, particulars, or to call.

E. W. BROWN, Sole Agent,

229 to 269 Chestnut Street, Brooklyn, N. Y.

INLET AT BOTTOM.

PATENTED MAY 13, 1902.

METRIC METAL COMPANY,

MAKERS OF

GAS METERS for NATURAL and ARTIFICIAL GAS.

Special Attention given to Repairing METERS of all Makes.

FACTORY AT ERIE, PA.

JOHN J. GRIFFIN & CO.,

1513 TO 1521 RACE STREET,
PHILADELPHIA.

859 West 47th Street,
NEW YORK.

Jefferson and Monroe Streets
CHICAGO.

GAS METERS,

Station Meters and Apparatus of Every Description.

REPAIRING CAREFULLY DONE.

THE POSITIVE PREPAYMENT METER.

OVER 600,000 OF THESE PREPAYMENT METERS ARE IN USE IN THE UNITED STATES, AND THE DEMAND IS STEADILY INCREASING.

If you have some ordinary meters to be repaired, send them to us and let us repair and convert them into prepayment meters. They will be a source of satisfaction and profit to you.

SEND FOR OUR CATALOGUE AND OUR PREPAYMENT BOOKLET.